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PRACTICAL TABLES FOR BUILDING CONSTRUCTION

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NORMAN FOSTER

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PRACTICAL TABLES FOR BUILDING CONSTRUCTION

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PREFACE

This book provides a convenient, pocket-size reference tool which can be used in the field by an architect, engineer, purchasing agent, estimator, job super, foreman, or craftsman. It contains all the tables that the author has found useful and helpful over the past 30 years, plus many that he developed especially for this book.

Whether carried in the pocket or kept handy on the desk, this book may be depended upon to give the right answer at once to problems of sizes, weights, mixes, covering capacity of material, masonry, layout, and so on. Figuring quantities for ordering concrete, purchasing, estimating, designing—all are made easier by use of the data contained herein.

Norman Foster

To Thomas Moody

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SECTION I
General Tables

1.1 WEIGHTS AND MEASURES

Linear Measure

1 rod	=	5.5 yd	=	16.5 ft		
1 furlong	=	40 rods	=	220 yd	=	660 ft
1 mile	=	8 furlongs	=	320 rods	=	1,760 yd = 5,280 ft

Square Measure

1 sq ft	=	144	sq in.		
1 sq yd	=	9	sq ft		
1 sq rod	=	30.25	sq yd		
1 acre	=	4,840	sq yd	=	43,560 sq ft
1 sq mile	=	640	acres		

Liquid Measure (U.S.A.)

1 pt	=	4	gills	=	0.01671 cu ft
1 qt	=	2	pt	=	0.03342 cu ft
1 gal	=	4	qt	=	0.1337 cu ft
1 barrel	=	31.5	gal	=	4.2112 cu ft
1 cu ft	=	7.4805	gal		

Gunter's Chain

1 link	=	7.92 in.	=	0.01 chain		
1 chain	=	100 links	=	66 ft	=	4 rods
1 mile	=	80 chains	=	8,000 links		

Nautical Measure

1 fathom	=	6 ft		
1 cable	=	120 fathoms		
1 nautical mile	=	1.1411 land miles	=	6,028 ft
1 nautical mile per hour	=		=	1 knot

1.2 CONVERSION OF WATER DATA

Conversion

1 gal (U.S.) of water = 8.33 lb = 0.1337 cu ft = 231 cu in.
7.48 gal (U.S.) of water = 62.4 lb = 1.0 cu ft = 1,728 cu in.
1 cu ft of salt water = 64.1 lb
1 gal (Imperial) of water = 10.0 lb = 0.1613 cu ft = 279 cu in.
1 gal (Imperial) = 1.2 gal (U.S.)
1 gal (U.S.) = 0.883 gal (Imperial)

Pressure

1 ft head of water = 0.433 psi
1 psi = 2.31 ft head of water
To convert pressure to head, multiply by 2.31
To convert head to pressure, multiply by 0.433
Atmospheric pressure = 14.7 psi at sea level
1 hp = 1 cu ft of water per second through 8.81 ft head
= 550 ft-lb per second

Velocity of Flow

1 ft per second = 0.682 mph
1 mph = 1.4667 ft per second
1 gal (U.S.) per minute = 0.002283 ft per second
1 cu ft per second = 449 gal (U.S.) per minute
1.547 cu ft per second = 1,000 gal (U.S.) per day

1.3 CONVERSION OF LAND AREAS

Area

1 sq mile = 640 acres = 102,400 sq rods = 3,097,600 sq yd
= 27,878,400 sq ft
1 acre = 160 sq rods = 4,840 sq yd = 43,560 sq ft
1 sq rod = $30\frac{1}{4}$ sq yd = $272\frac{1}{4}$ sq ft
1 sq yd = 9 sq ft

Land Measuring Factors

1 mile \times 1 mile contains 640 acres
1 sq acre is 208.71 ft \times 208.71 ft
1 circular acre has a 235.504 ft diameter

Square Plots

660 ft \times 660 ft = 10 acres = 435,600 sq ft
466.7 ft \times 466.7 ft = 5 acres = 217,800 sq ft
417.4 ft \times 417.4 ft = 4 acres = 174,240 sq ft
295.2 ft \times 295.2 ft = 2 acres = 87,120 sq ft
208.7 ft \times 208.7 ft = 1 acre = 43,560 sq ft
147.6 ft \times 147.6 ft = $\frac{1}{2}$ acre = 21,780 sq ft
104.4 ft \times 104.4 ft = $\frac{1}{4}$ acre = 10,890 sq ft
66 ft \times 66 ft = $\frac{1}{16}$ acre = 4,356 sq ft

Irregular Plots

40 ft \times 109 ft = 4,360 sq ft—slightly more than $\frac{1}{10}$ acre
40 ft \times 136 ft = 5,440 sq ft—slightly less than $\frac{1}{8}$ acre
50 ft \times 87 ft = 4,350 sq ft—slightly less than $\frac{1}{10}$ acre
50 ft \times 109 ft = 5,450 sq ft—slightly more than $\frac{1}{8}$ acre
50 ft \times 145 ft = 7,250 sq ft—slightly less than $\frac{1}{6}$ acre
60 ft \times 181 ft = 10,860 sq ft—slightly less than $\frac{1}{4}$ acre

1.4 TREES PER ACRE

Spacing, ft	Trees per acre	Spacing, ft	Trees per acre
2 × 2	10,890	9 × 12	403
3 × 3	4,840	9 × 15	323
4 × 4	2,722	10 × 10	436
4 × 5	2,178	10 × 12	363
4 × 6	1,815	10 × 15	290
4 × 7	1,556	10 × 18	242
4 × 8	1,361	11 × 11	360
4 × 9	1,210	11 × 12	330
4 × 10	1,089	11 × 15	264
5 × 5	1,742	11 × 20	198
5 × 6	1,452	11 × 25	158
5 × 7	1,245	12 × 12	302
5 × 8	1,089	12 × 15	242
5 × 9	968	12 × 18	202
5 × 10	871	12 × 20	182
6 × 6	1,210	12 × 25	145
6 × 7	1,037	13 × 13	258
6 × 8	908	13 × 15	223
6 × 9	807	13 × 20	168
6 × 10	726	13 × 25	134
8 × 12	605	14 × 14	222
8 × 15	484	14 × 15	207
7 × 7	889	14 × 20	156
7 × 8	778	14 × 25	124
7 × 9	691	15 × 15	194
7 × 10	622	15 × 20	145
7 × 12	519	15 × 25	116
7 × 15	415	16 × 16	170
8 × 8	681	16 × 20	136
8 × 9	605	16 × 25	109
8 × 10	544	18 × 18	134
8 × 12	454	18 × 20	121
8 × 15	363	18 × 25	97
8 × 25	218	20 × 20	109
9 × 9	538	20 × 25	87
9 × 10	484	25 × 25	70

1.5 CONVERSION FACTORS

Multiply	by	to obtain
acres	0.404687	hectares
"	4.04687×10^{-2}	square kilometers
ares	1076.39	square feet
board feet	$144 \text{ sq in.} \times 1 \text{ in.}$	cubic inches
"	0.0833	cubic feet
bushels	0.3521	hectoliters
centimeters	3.28083×10^{-2}	feet
"	0.3937	inches
cubic centimeters	3.53145×10^{-3}	cubic feet
"	6.102×10^{-5}	cubic inches
cubic feet	2.8317×10^4	cubic centimeters
"	2.8317×10^{-2}	cubic meters
"	6.22905	gallons, Imperial
"	0.2832	hectoliters
"	28.3170	liters
"	2.38095×10^{-3}	tons, British shipping
"	0.025	tons, U. S. shipping
cubic inches	16.38716	cubic centimeters
cubic meters	35.3145	cubic feet
"	1.30794	cubic yards
"	264.2	gallons, U. S.
cubic yards	0.764559	cubic meters
"	7.6336	hectoliters
degrees, angular	0.0174533	radians
degrees, F (less 32 F)	0.5556	degrees, C
" C	1.8	degrees, F (less 32 F)
foot pounds	0.13826	kilogram meters
feet	30.4801	centimeters
"	0.304801	meters
"	304.801	millimeters
"	1.64469×10^{-4}	miles, nautical
gallons, Imperial	0.160538	cubic feet
"	1.20091	gallons, U. S.
"	4.54596	liters
gallons, U.S.	0.832702	gallons, Imperial
"	0.13368	cubic feet
"	231.	cubic inches
"	0.0378	hectoliters
"	3.78543	liters
grams, metric	2.20462×10^{-3}	pounds, avoirdupois
hectares	2.47104	acres
"	1.076387×10^5	square feet
"	3.86101×10^{-5}	square miles
hectoliters	3.531	cubic feet
"	2.84	bushels
"	0.131	cubic yards

1.5 CONVERSION FACTORS (Cont.)

Multiply	by	to obtain
hectoliters	26.42	gallons
horsepower, metric	0.98632	horsepower, U. S.
horsepower, U.S.	1.01387	horsepower, metric
inches	2.54001	centimeters
"	2.54001×10^{-2}	meters
"	25.4001	millimeters
kilograms	2.20462	pounds
"	9.84206×10^{-4}	long tons
"	1.10231×10^{-3}	short tons
kilogram meters	7.233	foot pounds
kilograms per m	0.671972	pounds per ft
kilograms per sq cm	14.2234	pounds per sq in.
kilograms per sq m	0.204817	pounds per sq ft
" " " "	9.14362×10^{-3}	long tons per sq ft
kilograms per sq mm	1422.34	pounds per sq in.
" " " "	0.634973	long tons per sq in.
kilograms per cu m	6.24283×10^{-2}	pounds per cu ft
kilometers	0.62137	miles, statute
"	0.53959	miles, nautical
"	3280.7	feet
liters	0.219975	gallons, Imperial
"	0.26417	gallons, U.S.
"	3.53145×10^{-2}	cubic feet
"	61.022	cubic inches
meters	3.28083	feet
"	39.37	inches
"	1.09361	yards
miles, statute	1.60935	kilometers
" "	0.8684	miles, nautical
miles, nautical	6080.204	feet
" "	1.85325	kilometers
" "	1.1516	miles, statute
millimeters	3.28083×10^{-3}	feet
"	3.937×10^{-2}	inches
pounds, avoirdupois	453.592	grams, metric
" "	0.453592	kilograms
" "	4.464×10^{-4}	tons, long
" "	4.53592×10^{-4}	tons, metric
pounds per ft	1.48816	kilograms per m
pounds per sq ft	4.88241	kilograms per sq m
pounds per sq in.	7.031×10^{-3}	kilograms per sq cm
" " " "	7.031×10^{-4}	kilograms per sq mm
pounds per cu ft	16.0184	kilograms per cu m
radians	57.29578	degrees, angular
square centimeters	0.1550	square inches
square feet	9.29034×10^{-4}	ares

1.5 CONVERSION FACTORS (Cont.)

Multiply	by	to obtain
square feet	9.29034×10^{-6}	hectares
" "	0.0929034	square meters
square inches	6.45163	square centimeters
" "	645.163	square millimeters
square kilometers	247.104	acres
" "	0.3861	square miles
square meters	10.7639	square feet
" "	1.19599	square yards
square miles	259.0	hectares
" "	2.590	square kilometers
square millimeters	1.550×10^{-3}	square inches
square yards	0.83613	square meters
tons, long	1016.05	kilograms
" "	2240.	pounds
" "	1.01605	tons, metric
" "	1.120	tons, short
tons, long, per sq ft	1.09366×10^{-3}	kilograms per sq m
tons, long, per sq in.	1.57494	kilograms per sq mm
tons, metric	2204.62	pounds
" "	0.98421	tons, long
" "	1.10231	tons, short
tons, short	907.185	kilograms
" "	0.892857	tons, long
" "	0.907185	tons, metric
tons, British shipping	42.00	cubic feet
" " "	0.952381	tons, U. S. shipping
tons, U. S. shipping	40.00	cubic feet
" " "	1.050	tons, British shipping
yards	0.914402	meters

Courtesy American Institute of Steel Construction.

1.6 INCHES REDUCED TO DECIMALS OF A FOOT

Inches	Feet	Inches	Feet	Inches	Feet
$\frac{1}{16}$	0.0052	$\frac{11}{16}$	0.0573	6	0.5000
$\frac{1}{8}$	0.0104	$\frac{1}{4}$	0.0625	7	0.5833
$\frac{3}{16}$	0.0156	$\frac{5}{16}$	0.0677	8	0.6667
$\frac{1}{4}$	0.0208	$\frac{3}{8}$	0.0729	9	0.7500
$\frac{5}{16}$	0.0260	$\frac{7}{8}$	0.0781	10	0.8333
$\frac{3}{8}$	0.0313	1	0.0833	11	0.9167
$\frac{7}{16}$	0.0365	2	0.1667		
$\frac{1}{2}$	0.0417	3	0.2500		
$\frac{9}{16}$	0.0469	4	0.3333		
$\frac{5}{8}$	0.0521	5	0.4167		

1.7 FRACTIONS CONVERTED TO DECIMALS

Fraction	Decimal	Fraction	Decimal	Fraction	Decimal
$\frac{1}{16}$	0.015625	$\frac{11}{16}$	0.390625	$\frac{13}{16}$	0.765625
$\frac{1}{8}$	0.03125	$\frac{1}{4}$	0.40625	$\frac{3}{4}$	0.78125
$\frac{3}{16}$	0.046875	$\frac{5}{16}$	0.421875	$\frac{5}{8}$	0.796875
$\frac{1}{4}$	0.0625	$\frac{3}{8}$	0.4375	$\frac{3}{4}$	0.8125
$\frac{5}{16}$	0.078125	$\frac{7}{8}$	0.453125	$\frac{7}{8}$	0.828125
$\frac{3}{8}$	0.09375	$\frac{1}{2}$	0.46875	$\frac{1}{2}$	0.84375
$\frac{7}{16}$	0.109375	$\frac{1}{4}$	0.484375	$\frac{1}{4}$	0.859375
$\frac{1}{2}$	0.125	$\frac{1}{8}$	0.5	$\frac{1}{8}$	0.875
$\frac{9}{16}$	0.140625	$\frac{3}{16}$	0.515625	$\frac{3}{16}$	0.890625
$\frac{5}{8}$	0.15625	$\frac{1}{4}$	0.53125	$\frac{1}{4}$	0.90625
$\frac{11}{16}$	0.171875	$\frac{5}{16}$	0.546875	$\frac{5}{16}$	0.921875
$\frac{3}{4}$	0.1875	$\frac{3}{8}$	0.5625	$\frac{3}{8}$	0.9375
$\frac{7}{8}$	0.203125	$\frac{7}{8}$	0.578125	$\frac{7}{8}$	0.953125
$\frac{1}{2}$	0.21875	$\frac{1}{2}$	0.59375	$\frac{1}{2}$	0.96875
$\frac{1}{8}$	0.234375	$\frac{1}{8}$	0.609375	$\frac{1}{8}$	0.984375
$\frac{1}{16}$	0.25	$\frac{1}{16}$	0.625	1	1.0
$\frac{1}{4}$	0.265625	$\frac{1}{4}$	0.640625		
$\frac{3}{8}$	0.28125	$\frac{3}{8}$	0.65625		
$\frac{1}{2}$	0.296875	$\frac{1}{2}$	0.671875		
$\frac{3}{4}$	0.3125	$\frac{3}{4}$	0.6875		
$\frac{5}{8}$	0.328125	$\frac{5}{8}$	0.703125		
$\frac{7}{8}$	0.34375	$\frac{7}{8}$	0.71875		
$\frac{1}{2}$	0.359375	$\frac{1}{2}$	0.734375		
$\frac{1}{8}$	0.375	$\frac{1}{8}$	0.75		

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS
In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
13.5	0.5	621	23	1,228.5	45.5	1,836	68
27	1	634.5	23.5	1,242	46	1,849.5	68.5
40.5	1.5	648	24	1,255.5	46.5	1,863	69
54	2	661.5	24.5	1,269	47	1,876.5	69.5
67.5	2.5	675	25	1,282.5	47.5	1,890	70
81	3	688.5	25.5	1,296	48	1,903.5	70.5
94.5	3.5	702	26	1,309.5	48.5	1,917	71
108	4	715.5	26.5	1,323	49	1,930.5	71.5
121.5	4.5	729	27	1,336.5	49.5	1,944	72
135	5	742.5	27.5	1,350	50	1,957.5	72.5
148.5	5.5	756	28	1,363.5	50.5	1,971	73
162	6	769.5	28.5	1,377	51	1,984.5	73.5
175.5	6.5	783	29	1,390.5	51.5	1,998	74
189	7	796.5	29.5	1,404	52	2,011.5	74.5
202.5	7.5	810	30	1,417.5	52.5	2,025	75
216	8	823.5	30.5	1,431	53	2,038.5	75.5
229.5	8.5	837	31	1,444.5	53.5	2,052	76
243	9	850.5	31.5	1,458	54	2,065.5	76.5
256.5	9.5	864	32	1,471.5	54.5	2,079	77
270	10	877.5	32.5	1,485	55	2,092.5	77.5
283.5	10.5	891	33	1,498.5	55.5	2,106	78
297	11	904.5	33.5	1,512	56	2,119.5	78.5
310.5	11.5	918	34	1,525.5	56.5	2,133	79
324	12	931.5	34.5	1,539	57	2,146.5	79.5
337.5	12.5	945	35	1,552.5	57.5	2,160	80
351	13	958.5	35.5	1,566	58	2,173.5	80.5
364.5	13.5	972	36	1,579.5	58.5	2,187	81
378	14	985.5	36.5	1,593	59	2,200.5	81.5
391.5	14.5	999	37	1,606.5	59.5	2,214	82
405	15	1,012.5	37.5	1,620	60	2,227.5	82.5
418.5	15.5	1,026	38	1,633.5	60.5	2,241	83
432	16	1,039.5	38.5	1,647	61	2,254.5	83.5
445.5	16.5	1,053	39	1,660.5	61.5	2,268	84
459	17	1,066.5	39.5	1,674	62	2,281.5	84.5
472.5	17.5	1,080	40	1,687.5	62.5	2,295	85
486	18	1,093.5	40.5	1,701	63	2,308.5	85.5
499.5	18.5	1,107	41	1,714.5	63.5	2,322	86
513	19	1,120.5	41.5	1,728	64	2,335.5	86.5
526.5	19.5	1,134	42	1,741.5	64.5	2,349	87
540	20	1,147.5	42.5	1,755	65	2,362.5	87.5
553.5	20.5	1,161	43	1,768.5	65.5	2,376	88
567	21	1,174.5	43.5	1,782	66	2,389.5	88.5
580.5	21.5	1,188	44	1,795.5	66.5	2,403	89
594	22	1,201.5	44.5	1,809	67	2,416.5	89.5
607.5	22.5	1,215	45	1,822.5	67.5	2,430	90

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)

In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
2,443.5	90.5	3,051	113	3,658.5	135.5	4,266	158
2,457	91	3,064.5	113.5	3,672	136	4,279.5	158.5
2,470.5	91.5	3,078	114	3,685.5	136.5	4,293	159
2,484	92	3,091.5	114.5	3,699	137	4,306.5	159.5
2,497.5	92.5	3,105	115	3,712.5	137.5	4,320	160
2,511	93	3,118.5	115.5	3,726	138	4,333.5	160.5
2,524.5	93.5	3,132	116	3,739.5	138.5	4,347	161
2,538	94	3,145.5	116.5	3,753	139	4,360.5	161.5
2,551.5	94.5	3,159	117	3,766.5	139.5	4,374	162
2,565	95	3,172.5	117.5	3,780	140	4,387.5	162.5
2,578.5	95.5	3,186	118	3,793.5	140.5	4,401	163
2,592	96	3,199.5	118.5	3,807	141	4,414.5	163.5
2,605.5	96.5	3,213	119	3,820.5	141.5	4,428	164
2,619	97	3,226.5	119.5	3,834	142	4,441.5	164.5
2,632.5	97.5	3,240	120	3,847.5	142.5	4,455	165
2,646	98	3,253.5	120.5	3,861	143	4,468.5	165.5
2,659.5	98.5	3,267	121	3,874.5	143.5	4,482	166
2,673	99	3,280.5	121.5	3,888	144	4,495.5	166.5
2,686.5	99.5	3,294	122	3,901.5	144.5	4,509	167
2,700	100	3,307.5	122.5	3,915	145	4,522.5	167.5
2,713.5	100.5	3,321	123	3,928.5	145.5	4,536	168
2,727	101	3,334.5	123.5	3,942	146	4,549.5	168.5
2,740.5	101.5	3,348	124	3,955.5	146.5	4,563	169
2,754	102	3,361.5	124.5	3,969	147	4,576.5	169.5
2,767.5	102.5	3,375	125	3,982.5	147.5	4,590	170
2,781	103	3,388.5	125.5	3,996	148	4,603.5	170.5
2,794.5	103.5	3,402	126	4,009.5	148.5	4,617	171
2,808	104	3,415.5	126.5	4,023	149	4,630.5	171.5
2,821.5	104.5	3,429	127	4,036.5	149.5	4,644	172
2,835	105	3,442.5	127.5	4,050	150	4,657.5	172.5
2,848.5	105.5	3,456	128	4,063.5	150.5	4,671	173
2,862	106	3,469.5	128.5	4,077	151	4,684.5	173.5
2,875.5	106.5	3,483	129	4,090.5	151.5	4,698	174
2,889	107	3,496.5	129.5	4,104	152	4,711.5	174.5
2,902.5	107.5	3,510	130	4,117.5	152.5	4,725	175
2,916	108	3,523.5	130.5	4,131	153	4,738.5	175.5
2,929.5	108.5	3,537	131	4,144.5	153.5	4,752	176
2,943	109	3,550.5	131.5	4,158	154	4,765.5	176.5
2,956.5	109.5	3,564	132	4,171.5	154.5	4,779	177
2,970	110	3,577.5	132.5	4,185	155	4,792.5	177.5
2,983.5	110.5	3,591	133	4,198.5	155.5	4,806	178
2,997	111	3,604.5	133.5	4,212	156	4,819.5	178.5
3,010.5	111.5	3,618	134	4,225.5	156.5	4,833	179
3,024	112	3,631.5	134.5	4,239	157	4,846.5	179.5
3,037.5	112.5	3,645	135	4,252.5	157.5	4,860	180

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)
In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
4,873.5	180.5	5,481	203	6,088.5	225.5	6,696	248
4,887	181	5,494.5	203.5	6,102	226	6,709.5	248.5
4,900.5	181.5	5,508	204	6,115.5	226.5	6,723	249
4,914	182	5,521.5	204.5	6,129	227	6,736.5	249.5
4,927.5	182.5	5,535	205	6,142.5	227.5	6,750	250
4,941	183	5,548.5	205.5	6,156	228	6,763.5	250.5
4,954.5	183.5	5,562	206	6,169.5	228.5	6,777	251
4,968	184	5,575.5	206.5	6,183	229	6,790.5	251.5
4,981.5	184.5	5,589	207	6,196.5	229.5	6,804	252
4,995	185	5,602.5	207.5	6,210	230	6,817.5	252.5
5,008.5	185.5	5,616	208	6,223.5	230.5	6,831	253
5,022	186	5,629.5	208.5	6,237	231	6,844.5	253.5
5,035.5	186.5	5,643	209	6,250.5	231.5	6,858	254
5,049	187	5,656.5	209.5	6,264	232	6,871.5	254.5
5,062.5	187.5	5,670	210	6,277.5	232.5	6,885	255
5,076	188	5,683.5	210.5	6,291	233	6,898.5	255.5
5,089.5	188.5	5,697	211	6,304.5	233.5	6,912	256
5,103	189	5,710.5	211.5	6,318	234	6,925.5	256.5
5,116.5	189.5	5,724	212	6,331.5	234.5	6,939	257
5,130	190	5,737.5	212.5	6,345	235	6,952.5	257.5
5,143.5	190.5	5,751	213	6,358.5	235.5	6,966	258
5,157	191	5,764.5	213.5	6,372	236	6,979.5	258.5
5,170.5	191.5	5,778	214	6,385.5	236.5	6,993	259
5,184	192	5,791.5	214.5	6,399	237	7,006.5	259.5
5,197.5	192.5	5,805	215	6,412.5	237.5	7,020	260
5,211	193	5,818.5	215.5	6,426	238	7,033.5	260.5
5,224.5	193.5	5,832	216	6,439.5	238.5	7,047	261
5,238	194	5,845.5	216.5	6,453	239	7,060.5	261.5
5,251.5	194.5	5,859	217	6,466.5	239.5	7,074	262
5,265	195	5,872.5	217.5	6,480	240	7,087.5	262.5
5,278.5	195.5	5,886	218	6,493.5	240.5	7,101	263
5,292	196	5,899.5	218.5	6,507	241	7,114.5	263.5
5,305.5	196.5	5,913	219	6,520.5	241.5	7,128	264
5,319	197	5,926.5	219.5	6,534	242	7,141.5	264.5
5,332.5	197.5	5,940	220	6,547.5	242.5	7,155	265
5,346	198	5,953.5	220.5	6,561	243	7,168.5	265.5
5,359.5	198.5	5,967	221	6,574.5	243.5	7,182	266
5,373	199	5,980.5	221.5	6,588	244	7,195.5	266.5
5,386.5	199.5	5,994	222	6,601.5	244.5	7,209	267
5,400	200	6,007.5	222.5	6,615	245	7,222.5	267.5
5,413.5	200.5	6,021	223	6,628.5	245.5	7,236	268
5,427	201	6,034.5	223.5	6,642	246	7,249.5	268.5
5,440.5	201.5	6,048	224	6,655.5	246.5	7,263	269
5,454	202	6,061.5	224.5	6,669	247	7,276.5	269.5
5,467.5	202.5	6,075	225	6,682.5	247.5	7,290	270

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)

In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
7,303.5	270.5	7,911	293	8,518.5	315.5	9,126	338
7,317	271	7,924.5	293.5	8,532	316	9,139.5	338.5
7,330.5	271.5	7,938	294	8,545.5	316.5	9,153	339
7,344	272	7,951.5	294.5	8,559	317	9,166.5	339.5
7,357.5	272.5	7,965	295	8,572.5	317.5	9,180	340
7,371	273	7,978.5	295.5	8,586	318	9,193.5	340.5
7,384.5	273.5	7,992	296	8,599.5	318.5	9,207	341
7,398	274	8,005.5	296.5	8,613	319	9,220.5	341.5
7,411.5	274.5	8,019	297	8,626.5	319.5	9,234	342
7,425	275	8,032.5	297.5	8,640	320	9,247.5	342.5
7,438.5	275.5	8,046	298	8,653.5	320.5	9,261	343
7,452	276	8,059.5	298.5	8,667	321	9,274.5	343.5
7,465.5	276.5	8,073	299	8,680.5	321.5	9,288	344
7,479	277	8,086.5	299.5	8,694	322	9,301.5	344.5
7,492.5	277.5	8,100	300	8,707.5	322.5	9,315	345
7,506	278	8,113.5	300.5	8,721	323	9,328.5	345.5
7,519.5	278.5	8,127	301	8,734.5	323.5	9,342	346
7,533	279	8,140.5	301.5	8,748	324	9,355.5	346.5
7,546.5	279.5	8,154	302	8,761.5	324.5	9,369	347
7,560	280	8,167.5	302.5	8,775	325	9,382.5	347.5
7,573.5	280.5	8,181	303	8,788.5	325.5	9,396	348
7,587	281	8,194.5	303.5	8,802	326	9,409.5	348.5
7,600.5	281.5	8,208	304	8,815.5	326.5	9,423	349
7,614	282	8,221.5	304.5	8,829	327	9,436.5	349.5
7,627.5	282.5	8,235	305	8,842.5	327.5	9,450	350
7,641	283	8,248.5	305.5	8,856	328	9,463.5	350.5
7,654.5	283.5	8,262	306	8,869.5	328.5	9,477	351
7,668	284	8,275.5	306.5	8,883	329	9,490.5	351.5
7,681.5	284.5	8,289	307	8,896.5	329.5	9,504	352
7,695	285	8,302.5	307.5	8,910	330	9,517.5	352.5
7,708.5	285.5	8,316	308	8,923.5	330.5	9,531	353
7,722	286	8,329.5	308.5	8,937	331	9,544.5	353.5
7,735.5	286.5	8,343	309	8,950.5	331.5	9,558	354
7,749	287	8,356.5	309.5	8,964	332	9,571.5	354.5
7,762.5	287.5	8,370	310	8,977.5	332.5	9,585	355
7,776	288	8,383.5	310.5	8,991	333	9,598.5	355.5
7,789.5	288.5	8,397	311	9,004.5	333.5	9,612	356
7,803	289	8,410.5	311.5	9,018	334	9,625.5	356.5
7,816.5	289.5	8,424	312	9,031.5	334.5	9,639	357
7,830	290	8,437.5	312.5	9,045	335	9,652.5	357.5
7,843.5	290.5	8,451	313	9,058.5	335.5	9,666	358
7,857	291	8,464.5	313.5	9,072	336	9,679.5	358.5
7,870.5	291.5	8,478	314	9,085.5	336.5	9,693	359
7,884	292	8,491.5	314.5	9,099	337	9,706.5	359.5
7,897.5	292.5	8,505	315	9,112.5	337.5	9,720	360

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)

In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
9,733.5	360.5	10,341	383	10,948.5	405.5	11,556	428
9,747	361	10,354.5	383.5	10,962	406	11,569.5	428.5
9,760.5	361.5	10,368	384	10,975.5	406.5	11,583	429
9,774	362	10,381.5	384.5	10,989	407	11,596.5	429.5
9,787.5	362.5	10,395	385	11,002.5	407.5	11,610	430
9,801	363	10,408.5	385.5	11,016	408	11,623.5	430.5
9,814.5	363.5	10,422	386	11,029.5	408.5	11,637	431
9,828	364	10,435.5	386.5	11,043	409	11,650.5	431.5
9,841.5	364.5	10,449	387	11,056.5	409.5	11,664	432
9,855	365	10,462.5	387.5	11,070	410	11,677.5	432.5
9,868.5	365.5	10,476	388	11,083.5	410.5	11,691	433
9,882	366	10,489.5	388.5	11,097	411	11,704.5	433.5
9,895.5	366.5	10,503	389	11,110.5	411.5	11,718	434
9,909	367	10,516.5	389.5	11,124	412	11,731.5	434.5
9,922.5	367.5	10,530	390	11,137.5	412.5	11,745	435
9,936	368	10,543.5	390.5	11,151	413	11,758.5	435.5
9,949.5	368.5	10,557	391	11,164.5	413.5	11,772	436
9,963	369	10,570.5	391.5	11,178	414	11,785.5	436.5
9,976.5	369.5	10,584	392	11,191.5	414.5	11,799	437
9,990	370	10,598.5	392.5	11,205	415	11,812.5	437.5
10,003.5	370.5	10,611	393	11,218.5	415.5	11,826	438
10,017	371	10,624.5	393.5	11,232	416	11,839.5	438.5
10,030.5	371.5	10,638	394	11,245.5	416.5	11,853	439
10,044	372	10,651.5	394.5	11,259	417	11,866.5	439.5
10,057.5	372.5	10,665	395	11,272.5	417.5	11,880	440
10,071	373	10,678.5	395.5	11,286	418	11,893.5	440.5
10,084.5	373.5	10,692	396	11,299.5	418.5	11,907	441
10,098	374	10,705.5	396.5	11,313	419	11,920.5	441.5
10,111.5	374.5	10,719	397	11,326.5	419.5	11,934	442
10,125	375	10,732.5	397.5	11,340	420	11,947.5	442.5
10,138.5	375.5	10,746	398	11,353.5	420.5	11,961	443
10,152	376	10,759.5	398.5	11,367	421	11,974.5	443.5
10,165.5	376.5	10,773	399	11,380.5	421.5	11,988	444
10,179	377	10,786.5	399.5	11,394	422	12,001.5	444.5
10,192.5	377.5	10,800	400	11,407.5	422.5	12,015	445
10,206	378	10,813.5	400.5	11,421	423	12,028.5	445.5
10,219.5	378.5	10,827	401	11,434.5	423.5	12,042	446
10,233	379	10,840.5	401.5	11,448	424	12,055.5	446.5
10,246.5	379.5	10,854	402	11,461.5	424.5	12,069	447
10,260	380	10,867.5	402.5	11,475	425	12,082.5	447.5
10,273.5	380.5	10,881	403	11,488.5	425.5	12,096	448
10,287	381	10,894.5	403.5	11,502	426	12,109.5	448.5
10,300.5	381.5	10,908	404	11,515.5	426.5	12,123	449
10,314	382	10,921.5	404.5	11,529	427	12,136.5	449.5
10,327.5	382.5	10,935	405	11,542.5	427.5	12,150	450

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)

In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
12,163.5	450.5	12,771	473	13,378.5	495.5	13,986	518
12,177	451	12,784.5	473.5	13,392	496	13,999.5	518.5
12,190.5	451.5	12,798	474	13,405.5	496.5	14,013	519
12,204	452	12,811.5	474.5	13,419	497	14,026.5	519.5
12,217.5	452.5	12,825	475	13,432.5	497.5	14,040	520
12,231	453	12,838.5	475.5	13,446	498	14,053.5	520.5
12,244.5	453.5	12,852	476	13,459.5	498.5	14,067	521
12,258	454	12,865.5	476.5	13,473	499	14,080.5	521.5
12,271.5	454.5	12,879	477	13,486.5	499.5	14,094	522
12,285	455	12,892.5	477.5	13,500	500	14,107.5	522.5
12,298.5	455.5	12,906	478	13,513.5	500.5	14,121	523
12,312	456	12,919.5	478.5	13,527	501	14,134.5	523.5
12,325.5	456.5	12,933	479	13,539.5	501.5	14,148	524
12,339	457	12,946.5	479.5	13,554	502	14,161.5	524.5
12,352.5	457.5	12,960	480	13,567.5	502.5	14,175	525
12,366	458	12,973.5	480.5	13,581	503	14,188.5	525.5
12,379.5	458.5	12,987	481	13,594.5	503.5	14,202	526
12,393	459	13,000.5	481.5	13,608	504	14,215.5	526.5
12,406.5	459.5	13,014	482	13,621.5	504.5	14,229	527
12,420	460	13,027.5	482.5	13,635	505	14,242.5	527.5
12,433.5	460.5	13,041	483	13,648.5	505.5	14,256	528
12,447	461	13,054.5	483.5	13,662	506	14,269.5	528.5
12,460.5	461.5	13,068	484	13,675.5	506.5	14,283	529
12,474	462	13,081.5	484.5	13,689	507	14,296.5	529.5
12,487.5	462.5	13,095	485	13,702.5	507.5	14,310	530
12,501	463	13,108.5	485.5	13,716	508	14,323.5	530.5
12,514.5	463.5	13,122	486	13,729.5	508.5	14,337	531
12,528	464	13,135.5	486.5	13,743	509	14,350.5	531.5
12,541.5	464.5	13,149	487	13,756.5	509.5	14,364	532
12,555	465	13,162.5	487.5	13,770	510	14,377.5	532.5
12,568.5	465.5	13,176	488	13,783.5	510.5	14,391	533
12,582	466	13,189.5	488.5	13,797	511	14,404.5	533.5
12,595.5	466.5	13,203	489	13,810.5	511.5	14,418	534
12,609	467	13,216.5	489.5	13,824	512	14,431.5	534.5
12,622.5	467.5	13,230	490	13,837.5	512.5	14,445	535
12,636	468	13,243.5	490.5	13,851	513	14,458.5	535.5
12,649.5	468.5	13,257	491	13,864.5	513.5	14,472	536
12,663	469	13,270.5	491.5	13,878	514	14,485.5	536.5
12,676.5	469.5	13,284	492	13,891.5	514.5	14,499	537
12,690	470	13,297.5	492.5	13,905	515	14,512.5	537.5
12,703.5	470.5	13,311	493	13,918.5	515.5	14,526	538
12,717	471	13,324.5	493.5	13,932	516	14,539.5	538.5
12,730.5	471.5	13,338	494	13,945.5	516.5	14,553	539
12,744	472	13,351.5	494.5	13,959	517	14,566.5	539.5
12,757.5	472.5	13,365	495	13,972.5	517.5	14,580	540

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)

In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
14,593.5	540.5	15,201	563	15,808.5	585.5	16,416	608
14,607	541	15,214.5	563.5	15,822	586	16,429.5	608.5
14,620.5	541.5	15,228	564	15,835.5	586.5	16,443	609
14,634	542	15,241.5	564.5	15,849	587	16,456.5	609.5
14,647.5	542.5	15,255	565	15,862.5	587.5	16,470	610
14,661	543	15,268.5	565.5	15,876	588	16,483.5	610.5
14,674.5	543.5	15,282	566	15,889.5	588.5	16,497	611
14,688	544	15,295.5	566.5	15,903	589	16,510.5	611.5
14,701.5	544.5	15,309	567	15,916.5	589.5	16,524	612
14,715	545	15,322.5	567.5	15,930	590	16,537.5	612.5
14,728.5	545.5	15,336	568	15,943.5	590.5	16,551	613
14,742	546	15,349.5	568.5	15,957	591	16,564.5	613.5
14,755.5	546.5	15,363	569	15,970.5	591.5	16,578	614
14,769	547	15,376.5	569.5	15,984	592	16,591.5	614.5
14,782.5	547.5	15,390	570	15,997.5	592.5	16,605	615
14,796	548	15,403.5	570.5	16,011	593	16,618.5	615.5
14,809.5	548.5	15,417	571	16,024.5	593.5	16,632	616
14,823	549	15,430.5	571.5	16,038	594	16,645.5	616.5
14,836.5	549.5	15,444	572	16,051.5	594.5	16,659	617
14,850	550	15,457.5	572.5	16,065	595	16,672.5	617.5
14,863.5	550.5	15,471	573	16,078.5	595.5	16,686	618
14,877	551	15,484.5	573.5	16,092	596	16,699.5	618.5
14,890.5	551.5	15,498	574	16,105.5	596.5	16,713	619
14,904	552	15,511.5	574.5	16,119	597	16,726.5	619.5
14,917.5	552.5	15,525	575	16,132.5	597.5	16,740	620
14,931	553	15,538.5	575.5	16,146	598	16,753.5	620.5
14,944.5	553.5	15,552	576	16,159.5	598.5	16,767	621
14,958	554	15,565.5	576.5	16,173	599	16,780.5	621.5
14,971.5	554.5	15,579	577	16,186.5	599.5	16,794	622
14,985	555	15,592.5	577.5	16,200	600	16,807.5	622.5
14,998.5	555.5	15,606	578	16,213.5	600.5	16,821	623
15,012	556	15,619.5	578.5	16,227	601	16,834.5	623.5
15,025.5	556.5	15,633	579	16,240.5	601.5	16,848	624
15,039	557	15,646.5	579.5	16,254	602	16,861.5	624.5
15,052.5	557.5	15,660	580	16,267.5	602.5	16,875	625
15,066	558	15,673.5	580.5	16,281	603	16,888.5	625.5
15,079.5	558.5	15,687	581	16,294.5	603.5	16,902	626
15,093	559	15,700.5	581.5	16,308	604	16,915.5	626.5
15,106.5	559.5	15,714	582	16,321.5	604.5	16,929	627
15,120	560	15,727.5	582.5	16,335	605	16,942.5	627.5
15,133.5	560.5	15,741	583	16,348.5	605.5	16,956	628
15,147	561	15,754.5	583.5	16,362	606	16,969.5	628.5
15,160.5	561.5	15,768	584	16,375.5	606.5	16,983	629
15,174	562	15,781.5	584.5	16,389	607	16,996.5	629.5
15,187.5	562.5	15,795	585	16,402.5	607.5	17,010	630

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)

In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
17,023.5	630.5	17,631	653	18,238.5	675.5	18,846	698
17,037	631	17,644.5	653.5	18,252	676	18,859.5	698.5
17,050.5	631.5	17,658	654	18,265.5	676.5	18,873	699
17,064	632	17,671.5	654.5	18,279	677	18,886.5	699.5
17,077.5	632.5	17,685	655	18,292.5	677.5	18,900	700
17,091	633	17,698.5	655.5	18,306	678	18,913.5	700.5
17,104.5	633.5	17,712	656	18,319.5	678.5	18,927	701
17,118	634	17,725.5	656.5	18,333	679	18,940.5	701.5
17,131.5	634.5	17,739	657	18,346.5	679.5	18,954	702
17,145	635	17,752.5	657.5	18,360	680	18,967.5	702.5
17,158.5	635.5	17,766	658	18,373.5	680.5	18,981	703
17,172	636	17,779.5	658.5	18,387	681	18,994.5	703.5
17,185.5	636.5	17,793	659	18,400.5	681.5	19,008	704
17,199	637	17,806.5	659.5	18,414	682	19,021.5	704.5
17,212.5	637.5	17,820	660	18,427.5	682.5	19,035	705
17,226	638	17,833.5	660.5	18,441	683	19,048.5	705.5
17,239.5	638.5	17,847	661	18,454.5	683.5	19,062	706
17,253	639	17,860.5	661.5	18,468	684	19,075.5	706.5
17,266.5	639.5	17,874	662	18,481.5	684.5	19,089	707
17,280	640	17,887.5	662.5	18,495	685	19,102.5	707.5
17,293.5	640.5	17,901	663	18,508.5	685.5	19,116	708
17,307	641	17,914.5	663.5	18,522	686	19,129.5	708.5
17,320.5	641.5	17,928	664	18,535.5	686.5	19,143	709
17,334	642	17,941.5	664.5	18,549	687	19,156.5	709.5
17,347.5	642.5	17,955	665	18,562.5	687.5	19,170	710
17,361	643	17,968.5	665.5	18,576	688	19,183.5	710.5
17,374.5	643.5	17,982	666	18,589.5	688.5	19,197	711
17,388	644	17,995.5	666.5	18,603	689	19,210.5	711.5
17,401.5	644.5	18,009	667	18,616.5	689.5	19,224	712
17,415	645	18,022.5	667.5	18,630	690	19,237.5	712.5
17,428.5	645.5	18,036	668	18,643.5	690.5	19,251	713
17,442	646	18,049.5	668.5	18,657	691	19,264.5	713.5
17,455.5	646.5	18,063	669	18,670.5	691.5	19,278	714
17,469	647	18,076.5	669.5	18,684	692	19,291.5	714.5
17,482.5	647.5	18,090	670	18,697.5	692.5	19,305	715
17,496	648	18,103.5	670.5	18,711	693	19,318.5	715.5
17,509.5	648.5	18,117	671	18,724.5	693.5	19,332	716
17,523	649	18,130.5	671.5	18,738	694	19,345.5	716.5
17,536.5	649.5	18,144	672	18,751.5	694.5	19,359	717
17,550	650	18,157.5	672.5	18,765	695	19,372.5	717.5
17,563.5	650.5	18,171	673	18,778.5	695.5	19,386	718
17,577	651	18,184.5	673.5	18,792	696	19,399.5	718.5
17,590.5	651.5	18,198	674	18,805.5	696.5	19,413	719
17,604	652	18,211.5	674.5	18,819	697	19,426.5	719.5
17,617.5	652.5	18,225	675	18,832.5	697.5	19,440	720

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)

In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
19,453.5	720.5	20,061	743	20,668.5	765.5	21,276	788
19,467	721	20,074.5	743.5	20,682	766	21,289.5	788.5
19,480.5	721.5	20,088	744	20,695.5	766.5	21,303	789
19,494	722	20,101.5	744.5	20,709	767	21,316.5	789.5
19,507.5	722.5	20,115	745	20,722.5	767.5	21,330	790
19,521	723	20,128.5	745.5	20,736	768	21,343.5	790.5
19,534.5	723.5	20,142	746	20,749.5	768.5	21,357	791
19,548	724	20,155.5	746.5	20,763	769	21,370.5	791.5
19,561.5	724.5	20,169	747	20,776.5	769.5	21,384	792
19,575	725	20,182.5	747.5	20,790	770	21,397.5	792.5
19,588.5	725.5	20,196	748	20,803.5	770.5	21,411	793
19,602	726	20,209.5	748.5	20,817	771	21,424.5	793.5
19,615.5	726.5	20,223	749	20,830.5	771.5	21,438	794
19,629	727	20,236.5	749.5	20,844	772	21,451.5	794.5
19,642.5	727.5	20,250	750	20,857.5	772.5	21,465	795
19,656	728	20,263.5	750.5	20,871	773	21,478.5	795.5
19,669.5	728.5	20,277	751	20,884.5	773.5	21,492	796
19,683	729	20,290.5	751.5	20,898	774	21,505.5	796.5
19,696.5	729.5	20,304	752	20,911.5	774.5	21,519	797
19,710	730	20,317.5	752.5	20,925	775	21,532.5	797.5
19,723.5	730.5	20,331	753	20,938.5	775.5	21,546	798
19,737	731	20,344.5	753.5	20,952	776	21,559.5	798.5
19,750.5	731.5	20,358	754	20,965.5	776.5	21,573	799
19,764	732	20,371.5	754.5	20,979	777	21,586.5	799.5
19,777.5	732.5	20,385	755	20,992.5	777.5	21,600	800
19,791	733	20,398.5	755.5	21,006	778	21,613.5	800.5
19,804.5	733.5	20,412	756	21,019.5	778.5	21,627	801
19,818	734	20,425.5	756.5	21,033	779	21,640.5	801.5
19,831.5	734.5	20,439	757	21,046.5	779.5	21,654	802
19,845	735	20,452.5	757.5	21,060	780	21,667.5	802.5
19,858.5	735.5	20,466	758	21,073.5	780.5	21,681	803
19,872	736	20,479.5	758.5	21,087	781	21,694.5	803.5
19,885.5	736.5	20,493	759	21,100.5	781.5	21,708	804
19,899	737	20,506.5	759.5	21,114	782	21,721.5	804.5
19,912.5	737.5	20,520	760	21,127.5	782.5	21,735	805
19,926	738	20,533.5	760.5	21,141	783	21,748.5	805.5
19,939.5	738.5	20,547	761	21,154.5	783.5	21,762	806
19,953	739	20,560.5	761.5	21,168	784	21,775.5	806.5
19,966.5	739.5	20,574	762	21,181.5	784.5	21,789	807
19,980	740	20,587.5	762.5	21,195	785	21,802.5	807.5
19,993.5	740.5	20,601	763	21,108.5	785.5	21,816	808
20,007	741	20,614.5	763.5	21,222	786	21,829.5	808.5
20,020.5	741.5	20,628	764	21,235.5	786.5	21,843	809
20,034	742	20,641.5	764.5	21,249	787	21,856.5	809.5
20,047.5	742.5	20,655	765	21,262.5	787.5	21,870	810

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)

In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
21,883.5	810.5	22,491	833	23,098.5	855.5	23,706	878
21,897	811	22,504.5	833.5	23,112	856	23,719.5	878.5
21,910.5	811.5	22,518	834	23,125.5	856.5	23,733	879
21,924	812	22,531.5	834.5	23,139	857	23,746.5	879.5
21,937.5	812.5	22,545	835	23,152.5	857.5	23,760	880
21,951	813	22,558.5	835.5	23,166	858	23,773.5	880.5
21,964.5	813.5	22,572	836	23,179.5	858.5	23,787	881
21,978	814	22,585.5	836.5	23,193	859	23,800.5	881.5
21,991.5	814.5	22,599	837	23,206.5	859.5	23,814	882
22,005	815	22,612.5	837.5	23,220	860	23,827.5	882.5
22,018.5	815.5	22,626	838	23,233.5	860.5	23,841	883
22,032	816	22,639.5	838.5	23,247	861	23,854.5	883.5
22,045.5	816.5	22,653	839	23,260.5	861.5	23,868	884
22,059	817	22,666.5	839.5	23,274	862	23,881.5	884.5
22,072.5	817.5	22,680	840	23,288.5	862.5	23,895	885
22,086	818	22,693.5	840.5	23,301	863	23,908.5	885.5
22,099.5	818.5	22,707	841	23,314.5	863.5	23,922	886
22,113	819	22,720.5	841.5	23,328	864	23,935.5	886.5
22,126.5	819.5	22,734	842	23,341.5	864.5	23,949	887
22,140	820	22,747.5	842.5	23,355	865	23,962.5	887.5
22,153.5	820.5	22,761	843	23,368.5	865.5	23,976	888
22,167	821	22,774.5	843.5	23,382	866	23,989.5	888.5
22,180.5	821.5	22,788	844	23,395.5	866.5	24,003	889
22,194	822	22,801.5	844.5	23,409	867	24,016.5	889.5
22,207.5	822.5	22,815	845	23,422.5	867.5	24,030	890
22,221	823	22,828.5	845.5	23,436	868	24,043.5	890.5
22,234.5	823.5	22,842	846	23,449.5	868.5	24,057	891
22,248	824	22,855.5	846.5	23,463	869	24,070.5	891.5
22,261.5	824.5	22,869	847	23,476.5	869.5	24,084	892
22,275	825	22,882.5	847.5	23,490	870	24,097.5	892.5
22,288.5	825.5	22,896	848	23,503.5	870.5	24,111	893
22,302	826	22,909.5	848.5	23,517	871	24,124.5	893.5
22,315.5	826.5	22,923	849	23,530.5	871.5	24,138	894
22,329	827	22,936.5	849.5	23,544	872	24,151.5	894.5
22,342.5	827.5	22,950	850	23,557.5	872.5	24,165	895
22,356	828	22,963.5	850.5	23,571	873	24,178.5	895.5
22,369.5	828.5	22,977	851	23,584.5	873.5	24,192	896
22,383	829	22,990.5	851.5	23,598	874	24,205.5	896.5
22,396.5	829.5	23,004	852	23,611.5	874.5	24,219	897
22,410	830	23,017.5	852.5	23,625	875	24,232.5	897.5
22,423.5	830.5	23,031	853	23,638.5	875.5	24,246	898
22,437	831	23,044.5	853.5	23,652	876	24,259.5	898.5
22,450.5	831.5	23,058	854	23,665.5	876.5	24,273	899
22,464	832	23,071.5	854.5	23,679	877	24,286.5	899.5
22,477.5	832.5	23,085	855	23,692.5	877.5	24,300	900

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)
In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
24,313.5	900.5	24,921	923	25,528.5	945.5	26,136	968
24,327	901	24,934.5	923.5	25,542	946	26,149.5	968.5
24,340.5	901.5	24,948	924	25,555.5	946.5	26,163	969
24,354	902	24,961.5	924.5	25,569	947	26,176.5	969.5
24,367.5	902.5	24,975	925	25,582.5	947.5	26,190	970
24,381	903	24,988.5	925.5	25,596	948	26,203.5	970.5
24,394.5	903.5	25,002	926	25,609.5	948.5	26,217	971
24,408	904	25,015.5	926.5	25,623	949	26,230.5	971.5
24,421.5	904.5	25,029	927	25,636.5	949.5	26,244	972
24,435	905	25,042.5	927.5	25,650	950	26,257.5	972.5
24,448.5	905.5	25,056	928	25,663.5	950.5	26,271	973
24,462	906	25,069.5	928.5	25,677	951	26,284.5	973.5
24,475.5	906.5	25,083	929	25,690.5	951.5	26,298	974
24,489	907	25,096.5	929.5	25,704	952	26,311.5	974.5
24,502.5	907.5	25,110	930	25,717.5	952.5	26,325	975
24,516	908	25,123.5	930.5	25,731	953	26,338.5	975.5
24,529.5	908.5	25,137	931	25,744.5	953.5	26,352	976
24,543	909	25,150.5	931.5	25,757	954	26,365.5	976.5
24,556.5	909.5	25,164	932	25,771.5	954.5	26,379	977
24,570	910	25,177.5	932.5	25,785	955	26,392.5	977.5
24,583.5	910.5	25,191	933	25,798.5	955.5	26,406	978
24,597	911	25,204.5	933.5	25,812	956	26,419.5	978.5
24,610.5	911.5	25,218	934	25,825.5	956.5	26,433	979
24,624	912	25,231.5	934.5	25,839	957	26,446.5	979.5
24,637.5	912.5	25,245	935	25,852.5	957.5	26,460	980
24,651	913	25,258.5	935.5	25,866	958	26,473.5	980.5
24,664.5	913.5	25,272	936	25,879.5	958.5	26,487	981
24,678	914	25,285.5	936.5	25,893	959	26,500.5	981.5
24,691.5	914.5	25,299	937	25,906.5	959.5	26,514	982
24,705	915	25,312.5	937.5	25,920	960	26,527.5	982.5
24,718.5	915.5	25,326	938	25,933.5	960.5	26,541	983
24,732	916	25,339.5	938.5	25,947	961	26,554.5	983.5
24,745.5	916.5	25,353	939	25,960.5	961.5	26,568	984
24,759	917	25,366.5	939.5	25,974	962	26,581.5	984.5
24,772.5	917.5	25,380	940	25,987.5	962.5	26,595	985
24,786	918	25,393.5	940.5	26,001	963	26,608.5	985.5
24,799.5	918.5	25,407	941	26,014.5	963.5	26,622	986
24,813	919	25,420.5	941.5	26,028	964	26,635.5	986.5
24,826.5	919.5	25,434	942	26,041.5	964.5	26,649	987
24,840	920	25,447.5	942.5	26,055	965	26,662.5	987.5
24,853.5	920.5	25,461	943	26,068.5	965.5	26,676	988
24,867	921	25,474.5	943.5	26,082	966	26,689.5	988.5
24,880.5	921.5	25,488	944	26,095.5	966.5	26,703	989
24,894	922	25,501.5	944.5	26,109	967	26,716.5	989.5
24,907.5	922.5	25,515	945	26,122.5	967.5	26,730	990

1.8 CONVERSION OF CUBIC FEET TO CUBIC YARDS (Cont.)

In multiples of 13.5 cu ft (0.5 cu yd)

Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd	Cu ft	Cu yd
26,743.5	990.5	26,811	993	26,878.5	995.5	26,946	998
26,757	991	26,824.5	993.5	26,892	996	26,959.5	998.5
26,770.5	991.5	26,838	994	26,905.5	996.5	26,973	999
26,784	992	26,851.5	994.5	26,919	997	26,986.5	999.5
26,797.5	992.5	26,865	995	26,932.5	997.5	27,000	1,000

1.9 FUNCTIONS OF NUMBERS

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
1	1	1	1.0000	1.0000	0.00000	1000.000	3.142	0.7854
2	4	8	1.4142	1.2599	0.30103	500.000	6.283	3.1416
3	9	27	1.7321	1.4422	0.47712	333.333	9.425	7.0686
4	16	64	2.0000	1.5874	0.60206	250.000	12.566	12.5664
5	25	125	2.2361	1.7100	0.69897	200.000	15.708	19.6350
6	36	216	2.4495	1.8171	0.77815	166.667	18.850	28.2743
7	49	343	2.6458	1.9129	0.84510	142.857	21.991	38.4845
8	64	512	2.8284	2.0000	0.90309	125.000	25.133	50.2656
9	81	729	3.0000	2.0801	0.95424	111.111	28.274	63.6173
10	100	1000	3.1623	2.1544	1.00000	100.000	31.416	78.5398
11	121	1331	3.3166	2.2240	1.04139	90.9091	34.558	95.0332
12	144	1728	3.4641	2.2894	1.07918	83.3333	37.699	113.097
13	169	2197	3.6066	2.3513	1.11394	76.9231	40.841	132.732
14	196	2744	3.7417	2.4101	1.14613	71.4286	43.982	153.938
15	225	3375	3.8730	2.4682	1.17909	66.6667	47.124	176.715
16	256	4096	4.0000	2.5198	1.20412	62.5000	50.265	201.062
17	289	4913	4.1231	2.5713	1.23045	58.8235	53.407	226.980
18	324	5832	4.2426	2.6207	1.25527	55.5556	56.549	254.469
19	361	6859	4.3589	2.6684	1.27875	52.6316	59.690	283.529
20	400	8000	4.4721	2.7144	1.30103	50.0000	62.832	314.159
21	441	9261	4.5826	2.7589	1.32222	47.6190	65.973	346.361
22	484	10648	4.6904	2.8020	1.34242	45.4545	69.115	380.133
23	529	12167	4.7958	2.8439	1.36173	43.4783	72.257	415.476
24	576	13824	4.8990	2.8845	1.38021	41.6667	75.398	452.389
25	625	15625	5.0000	2.9240	1.39794	40.0000	78.540	490.874
26	676	17776	5.0990	2.9625	1.41497	38.4615	81.681	530.929
27	729	19683	5.1962	3.0000	1.43136	37.0370	84.823	572.555
28	784	21952	5.2915	3.0366	1.44716	35.7143	87.965	615.752
29	841	24389	5.3852	3.0723	1.46240	34.4828	91.106	660.520
30	900	27000	5.4772	3.1072	1.47712	33.3333	94.248	706.858
31	961	29791	5.5678	3.1414	1.49136	32.2581	97.389	754.768
32	1024	32768	5.6569	3.1748	1.50515	31.2500	100.531	804.248
33	1089	35937	5.7446	3.2075	1.51851	30.3030	103.673	855.299
34	1156	39304	5.8310	3.2396	1.53148	29.4118	106.814	907.920
35	1225	42875	5.9161	3.2711	1.54407	28.5714	109.956	962.113
36	1296	46656	6.0000	3.3019	1.55630	27.7778	113.097	1017.68
37	1369	50653	6.0828	3.3322	1.56820	27.0270	116.239	1075.21
38	1444	54872	6.1644	3.3620	1.57978	26.3158	119.381	1134.11
39	1521	59319	6.2450	3.3912	1.59105	25.6410	122.522	1194.59
40	1600	64000	6.3246	3.4200	1.60206	25.0000	125.66	1256.64
41	1681	68921	6.4031	3.4482	1.61278	24.3902	128.81	1320.25
42	1764	74088	6.4807	3.4760	1.62325	23.8095	131.95	1385.44
43	1849	79507	6.5574	3.5034	1.63347	23.2558	135.09	1452.30
44	1936	85184	6.6332	3.5303	1.64345	22.7273	138.23	1520.53
45	2025	91125	6.7082	3.5569	1.65321	22.2222	141.37	1590.43
46	2116	97336	6.7823	3.5830	1.66276	21.7391	144.51	1661.90
47	2209	103823	6.8557	3.6088	1.67210	21.2766	147.65	1734.94
48	2304	110592	6.9282	3.6342	1.68124	20.8333	150.80	1809.56
49	2401	117649	7.0000	3.6593	1.69020	20.4082	153.94	1885.74

FUNCTIONS OF NUMBERS

50
99

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
50	2500	125000	7.0711	3.6840	1.69897	20.0000	157.08	1963.50
51	2601	132651	7.1414	3.7084	1.70757	19.6078	160.22	2042.82
52	2704	140608	7.2111	3.7325	1.71600	19.2308	163.36	2123.72
53	2809	148877	7.2801	3.7563	1.72428	18.8679	166.50	2206.18
54	2916	157464	7.3485	3.7798	1.73239	18.5185	169.65	2290.22
55	3025	166375	7.4162	3.8030	1.74036	18.1818	172.79	2375.83
56	3136	175616	7.4833	3.8259	1.74819	17.8571	175.93	2463.01
57	3249	185193	7.5498	3.8485	1.75587	17.5439	179.07	2551.76
58	3364	195112	7.6156	3.8709	1.76343	17.2414	182.21	2642.08
59	3481	205379	7.6811	3.8930	1.77085	16.9492	185.35	2733.97
60	3600	216000	7.7460	3.9149	1.77815	16.6667	188.50	2827.43
61	3721	226981	7.8102	3.9365	1.78533	16.3934	191.64	2922.47
62	3844	238328	7.8740	3.9579	1.79239	16.1290	194.78	3019.07
63	3969	250047	7.9373	3.9791	1.79934	15.8730	197.92	3117.25
64	4096	262144	8.0000	4.0000	1.80618	15.6250	201.06	3216.99
65	4225	274625	8.0623	4.0207	1.81291	15.3846	204.20	3318.31
66	4356	287496	8.1240	4.0412	1.81954	15.1515	207.35	3421.19
67	4489	300763	8.1854	4.0615	1.82607	14.9254	210.49	3525.65
68	4624	314432	8.2462	4.0817	1.83251	14.7059	213.63	3631.68
69	4761	328509	8.3066	4.1016	1.83885	14.4928	216.77	3739.28
70	4900	343000	8.3666	4.1213	1.84510	14.2857	219.91	3848.45
71	5041	357911	8.4261	4.1408	1.85126	14.0845	223.05	3959.19
72	5184	373248	8.4853	4.1602	1.85733	13.8889	226.19	4071.50
73	5329	389017	8.5444	4.1793	1.86332	13.6986	229.34	4185.39
74	5476	405224	8.6023	4.1983	1.86923	13.5135	232.48	4300.84
75	5625	421875	8.6603	4.2172	1.87506	13.3333	235.62	4417.85
76	5776	438976	8.7178	4.2358	1.88081	13.1579	238.76	4536.46
77	5929	456533	8.7750	4.2543	1.88649	12.9870	241.90	4656.63
78	6084	474552	8.8318	4.2727	1.89209	12.8205	245.04	4778.36
79	6241	493039	8.8882	4.2908	1.89763	12.6582	248.19	4901.67
80	6400	512000	8.9443	4.3089	1.90309	12.5000	251.33	5026.55
81	6561	531441	9.0000	4.3267	1.90849	12.3457	254.47	5153.00
82	6724	551368	9.0554	4.3445	1.91381	12.1951	257.61	5281.02
83	6889	571787	9.1104	4.3621	1.91906	12.0482	260.75	5410.61
84	7056	592704	9.1652	4.3795	1.92428	11.9048	263.89	5541.77
85	7225	614125	9.2195	4.3968	1.92942	11.7647	267.04	5674.50
86	7396	636056	9.2736	4.4140	1.93450	11.6279	270.18	5808.80
87	7569	658503	9.3274	4.4310	1.93952	11.4943	273.32	5944.68
88	7744	681472	9.3808	4.4480	1.94448	11.3636	276.46	6082.12
89	7921	704969	9.4340	4.4647	1.94939	11.2360	279.60	6221.14
90	8100	729000	9.4868	4.4814	1.95424	11.1111	282.74	6361.73
91	8281	753571	9.5394	4.4979	1.95904	10.9890	285.88	6503.88
92	8464	778688	9.5917	4.5144	1.96379	10.8696	289.03	6647.61
93	8649	804357	9.6437	4.5307	1.96848	10.7527	292.17	6792.91
94	8836	830584	9.6954	4.5468	1.97313	10.6383	295.31	6939.78
95	9025	857375	9.7468	4.5629	1.97772	10.5263	298.45	7088.22
96	9216	884736	9.7980	4.5789	1.98227	10.4167	301.59	7238.23
97	9409	912673	9.8489	4.5947	1.98677	10.3093	304.73	7389.81
98	9604	941192	9.8995	4.6104	1.99123	10.2041	307.88	7542.96
99	9801	970299	9.9499	4.6261	1.99564	10.1010	311.02	7697.69

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

FUNCTIONS OF NUMBERS

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
100	10000	1000000	10.0000	4.6416	2.00000	10.0000	314.16	7853.98
101	10201	1030301	10.0499	4.6570	2.00432	9.90089	317.30	8011.85
102	10404	1061208	10.0995	4.6723	2.00860	9.80392	320.44	8171.26
103	10609	1092727	10.1489	4.6875	2.01284	9.70874	323.58	8332.29
104	10816	1124864	10.1980	4.7027	2.01703	9.61538	326.73	8494.87
105	11025	1157625	10.2470	4.7177	2.02119	9.52381	329.87	8659.01
106	11236	1191016	10.2956	4.7326	2.02531	9.43396	333.01	8824.73
107	11449	1225043	10.3441	4.7475	2.02938	9.34579	336.15	8992.02
108	11664	1259712	10.3923	4.7622	2.03342	9.25926	339.29	9160.86
109	11881	1295029	10.4403	4.7769	2.03743	9.17431	342.43	9331.32
110	12100	1331000	10.4881	4.7914	2.04139	9.09091	345.58	9503.32
111	12321	1367631	10.5357	4.8059	2.04532	9.00901	348.72	9676.89
112	12544	1404928	10.5830	4.8203	2.04922	8.92857	351.86	9852.03
113	12769	1442997	10.6301	4.8346	2.05308	8.84956	355.00	10028.7
114	12996	1481844	10.6771	4.8488	2.05690	8.77193	358.14	10207.0
115	13225	1520675	10.7238	4.8629	2.06070	8.69565	361.28	10386.9
116	13456	1560896	10.7703	4.8770	2.06446	8.62069	364.42	10568.3
117	13689	1601613	10.8167	4.8910	2.06819	8.54701	367.57	10751.3
118	13924	1643032	10.8628	4.9049	2.07188	8.47458	370.71	10935.9
119	14161	1685159	10.9087	4.9187	2.07555	8.40336	373.85	11122.0
120	14400	1728000	10.9545	4.9324	2.07918	8.33333	376.99	11309.7
121	14641	1771561	11.0000	4.9461	2.08279	8.26446	380.13	11499.0
122	14884	1815848	11.0454	4.9597	2.08636	8.19672	383.27	11689.9
123	15129	1860867	11.0906	4.9732	2.08991	8.13008	386.42	11882.3
124	15376	1906624	11.1355	4.9866	2.09342	8.06452	389.56	12076.3
125	15625	1953125	11.1803	5.0000	2.09691	8.00000	392.70	12271.8
126	15876	2000376	11.2250	5.0133	2.10037	7.93651	395.84	12469.0
127	16129	2048383	11.2694	5.0265	2.10380	7.87402	398.98	12667.7
128	16384	2097152	11.3137	5.0397	2.10721	7.81250	402.12	12868.0
129	16641	2146689	11.3578	5.0528	2.11059	7.75194	405.27	13069.8
130	16900	2197000	11.4018	5.0658	2.11394	7.69231	408.41	13273.2
131	17161	2248091	11.4455	5.0788	2.11727	7.63359	411.55	13478.2
132	17424	2299968	11.4891	5.0916	2.12057	7.57576	414.69	13684.8
133	17689	2352637	11.5326	5.1045	2.12385	7.51880	417.83	13892.9
134	17956	2406104	11.5758	5.1172	2.12710	7.46269	420.97	14102.6
135	18225	2460375	11.6190	5.1299	2.13033	7.40741	424.12	14313.9
136	18496	2515456	11.6619	5.1426	2.13354	7.35294	427.26	14526.7
137	18769	2571353	11.7047	5.1551	2.13672	7.29927	430.40	14741.1
138	19044	2628072	11.7473	5.1676	2.13988	7.24638	433.54	14957.1
139	19321	2685619	11.7898	5.1801	2.14301	7.19424	436.68	15174.7
140	19600	2744000	11.8322	5.1925	2.14613	7.14286	439.82	15393.8
141	19881	2803221	11.8743	5.2048	2.14922	7.09220	442.96	15614.5
142	20164	2863288	11.9164	5.2171	2.15229	7.04225	446.11	15836.8
143	20449	2924207	11.9583	5.2293	2.15534	6.99301	449.25	16060.6
144	20736	2985984	12.0000	5.2415	2.15836	6.94444	452.39	16286.0
145	21025	3048625	12.0416	5.2536	2.16137	6.89655	455.53	16513.0
146	21316	3112136	12.0830	5.2656	2.16435	6.84932	458.67	16741.5
147	21609	3176523	12.1244	5.2776	2.16732	6.80276	461.81	16971.7
148	21904	3241792	12.1655	5.2896	2.17026	6.75686	464.96	17203.4
149	22201	3307949	12.2066	5.3015	2.17319	6.71141	468.10	17436.6

FUNCTIONS OF NUMBERS

150

199

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
150	22500	3375000	12.2474	5.3133	2.17509	6.66667	471.24	17671.5
151	22801	3442951	12.2882	5.3251	2.17898	6.62252	474.38	17907.9
152	23104	3511808	12.3288	5.3368	2.18184	6.57895	477.52	18145.8
153	23409	3581577	12.3693	5.3485	2.18469	6.53595	480.66	18385.4
154	23716	3652264	12.4097	5.3601	2.18752	6.49351	483.81	18626.5
155	24025	3723875	12.4499	5.3717	2.19033	6.45161	486.95	18869.2
156	24336	3796416	12.4900	5.3832	2.19312	6.41026	490.09	19113.4
157	24649	3869893	12.5300	5.3947	2.19590	6.36943	493.23	19359.3
158	24964	3944312	12.5698	5.4061	2.19866	6.32911	496.37	19606.7
159	25281	4019679	12.6095	5.4175	2.20140	6.28931	499.51	19855.7
160	25600	4096000	12.6491	5.4288	2.20412	6.25000	502.65	20106.2
161	25921	4173281	12.6886	5.4401	2.20683	6.21118	505.80	20358.3
162	26244	4251528	12.7279	5.4514	2.20952	6.17284	508.94	20612.0
163	26569	4330747	12.7671	5.4626	2.21219	6.13497	512.08	20867.2
164	26896	4410944	12.8062	5.4737	2.21484	6.09756	515.22	21124.1
165	27225	4492125	12.8452	5.4848	2.21748	6.06061	518.36	21382.5
166	27556	4574296	12.8841	5.4959	2.22011	6.02410	521.50	21642.4
167	27889	4657463	12.9228	5.5069	2.22272	5.98802	524.65	21904.0
168	28224	4741632	12.9615	5.5178	2.22531	5.95238	527.79	22167.1
169	28561	4826809	13.0000	5.5288	2.22789	5.91716	530.93	22431.8
170	28900	4913000	13.0384	5.5397	2.23045	5.88235	534.07	22698.0
171	29241	5000211	13.0767	5.5505	2.23300	5.84795	537.21	22965.8
172	29584	5088448	13.1149	5.5613	2.23553	5.81395	540.35	23235.2
173	29929	5177717	13.1529	5.5721	2.23805	5.78035	543.50	23506.2
174	30276	5268024	13.1909	5.5828	2.24055	5.74713	546.64	23778.7
175	30625	5359375	13.2288	5.5934	2.24304	5.71429	549.78	24052.8
176	30976	5451776	13.2665	5.6041	2.24551	5.68182	552.92	24328.5
177	31329	5545233	13.3041	5.6147	2.24797	5.64972	556.06	24605.7
178	31684	5639752	13.3417	5.6252	2.25042	5.61798	559.20	24884.6
179	32041	5735339	13.3791	5.6357	2.25285	5.58659	562.35	25164.9
180	32400	5832000	13.4164	5.6462	2.25527	5.55556	565.49	25446.9
181	32761	5929741	13.4536	5.6567	2.25768	5.52486	568.63	25730.4
182	33124	6028568	13.4907	5.6671	2.26007	5.49451	571.77	26015.5
183	33489	6128487	13.5277	5.6774	2.26245	5.46448	574.91	26302.2
184	33856	6229504	13.5647	5.6877	2.26482	5.43478	578.05	26590.4
185	34225	6331625	13.6015	5.6980	2.26717	5.40541	581.19	26880.3
186	34596	6434856	13.6382	5.7083	2.26951	5.37634	584.34	27171.6
187	34969	6539203	13.6748	5.7185	2.27184	5.34759	587.48	27464.6
188	35344	6644672	13.7113	5.7287	2.27416	5.31915	590.62	27759.1
189	35721	6751269	13.7477	5.7388	2.27646	5.29101	593.76	28055.2
190	36100	6859000	13.7840	5.7489	2.27875	5.26316	596.90	28352.9
191	36481	6967871	13.8203	5.7590	2.28103	5.23560	600.04	28652.1
192	36864	7077888	13.8564	5.7690	2.28330	5.20833	603.19	28952.9
193	37249	7189057	13.8924	5.7790	2.28556	5.18135	606.33	29255.3
194	37636	7301384	13.9284	5.7890	2.28780	5.15464	609.47	29559.2
195	38025	7414875	13.9642	5.7989	2.29003	5.12821	612.61	29864.8
196	38416	7529536	14.0000	5.8088	2.29226	5.10204	615.75	30171.9
197	38809	7645373	14.0357	5.8186	2.29447	5.07614	618.89	30480.5
198	39204	7762392	14.0712	5.8285	2.29667	5.05051	622.04	30790.7
199	39601	7880599	14.1067	5.8383	2.29885	5.02513	625.18	31102.6

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

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FUNCTIONS OF NUMBERS

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
200	40000	8000000	14.1421	5.8480	2.30103	5.00000	628.32	31415.9
201	40401	8120601	14.1774	5.8578	2.30330	4.97512	631.46	31730.9
202	40804	8242408	14.2127	5.8675	2.30555	4.95050	634.60	32047.4
203	41209	8365427	14.2478	5.8771	2.30750	4.92611	637.74	32365.5
204	41616	8489664	14.2829	5.8868	2.30963	4.90190	640.88	32685.1
205	42025	8615125	14.3178	5.8964	2.31175	4.87805	644.03	33006.4
206	42436	8741816	14.3527	5.9059	2.31387	4.85437	647.17	33329.2
207	42849	8869743	14.3875	5.9155	2.31597	4.83092	650.31	33653.5
208	43264	8998912	14.4222	5.9250	2.31806	4.80769	653.45	33979.5
209	43681	9129329	14.4568	5.9345	2.32015	4.78469	656.59	34307.0
210	44100	9261000	14.4914	5.9439	2.32222	4.76190	659.73	34636.1
211	44521	9393931	14.5258	5.9533	2.32428	4.73934	662.88	34966.7
212	44944	9528128	14.5602	5.9627	2.32634	4.71698	666.02	35298.9
213	45369	9663597	14.5945	5.9721	2.32838	4.69484	669.16	35632.7
214	45796	9800344	14.6287	5.9814	2.33041	4.67290	672.30	35968.1
215	46225	9938375	14.6629	5.9907	2.33244	4.65116	675.44	36305.0
216	46656	10077696	14.6969	6.0000	2.33446	4.62963	678.58	36643.5
217	47089	10218313	14.7309	6.0092	2.33646	4.60829	681.73	36983.6
218	47524	10360232	14.7648	6.0185	2.33846	4.58716	684.87	37325.3
219	47961	10503459	14.7988	6.0277	2.34044	4.56621	688.01	37668.5
220	48400	10648000	14.8324	6.0368	2.34242	4.54545	691.15	38013.3
221	48841	10793861	14.8661	6.0459	2.34439	4.52489	694.29	38359.6
222	49284	10941048	14.8997	6.0550	2.34635	4.50450	697.43	38707.6
223	49729	11089567	14.9332	6.0641	2.34830	4.48430	700.58	39057.1
224	50176	11239424	14.9666	6.0732	2.35025	4.46429	703.72	39408.1
225	50625	11390625	15.0000	6.0822	2.35218	4.44444	706.86	39760.8
226	51076	11543176	15.0333	6.0912	2.35411	4.42478	710.00	40115.0
227	51529	11697083	15.0665	6.1002	2.35603	4.40529	713.14	40470.8
228	51984	11852352	15.0997	6.1091	2.35793	4.38596	716.28	40828.1
229	52441	12008989	15.1327	6.1180	2.35984	4.36681	719.42	41187.1
230	52900	12167000	15.1658	6.1269	2.36173	4.34783	722.57	41547.6
231	53361	12326391	15.1987	6.1358	2.36361	4.32900	725.71	41909.6
232	53824	12487168	15.2315	6.1446	2.36549	4.31034	728.85	42273.3
233	54289	12649337	15.2643	6.1534	2.36736	4.29185	731.99	42638.5
234	54756	12812904	15.2971	6.1622	2.36922	4.27350	735.13	43005.3
235	55225	12977875	15.3297	6.1710	2.37107	4.25532	738.27	43373.6
236	55696	13144256	15.3623	6.1797	2.37291	4.23729	741.42	43743.5
237	56169	13312053	15.3948	6.1885	2.37473	4.21941	744.56	44115.0
238	56644	13481272	15.4272	6.1972	2.37658	4.20168	747.70	44488.1
239	57121	13651919	15.4596	6.2058	2.37840	4.18410	750.84	44862.7
240	57600	13824000	15.4919	6.2145	2.38021	4.16667	753.98	45238.9
241	58081	13997521	15.5242	6.2231	2.38202	4.14938	757.12	45616.7
242	58564	14172488	15.5563	6.2317	2.38382	4.13223	760.27	45996.1
243	59049	14348907	15.5885	6.2403	2.38561	4.11523	763.41	46377.0
244	59536	14526784	15.6205	6.2488	2.38739	4.09836	766.55	46759.5
245	60025	14706125	15.6525	6.2573	2.38917	4.08163	769.69	47143.5
246	60516	14886936	15.6844	6.2658	2.39094	4.06504	772.83	47529.2
247	61009	15069223	15.7162	6.2743	2.39270	4.04858	775.97	47916.4
248	61504	15252992	15.7480	6.2828	2.39445	4.03226	779.12	48305.1
249	62001	15438249	15.7797	6.2912	2.39620	4.01606	782.26	48695.5

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

FUNCTIONS OF NUMBERS

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No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
250	62500	15625000	15.8114	6.2996	2.39794	4.00000	785.40	49087.4
251	63001	15813251	15.8430	6.3080	2.39967	3.98406	788.54	49480.9
252	63504	16003008	15.8745	6.3164	2.40140	3.96825	791.68	49875.9
253	64009	16194277	15.9060	6.3247	2.40312	3.95257	794.82	50272.6
254	64516	16387064	15.9374	6.3330	2.40483	3.93701	797.96	50670.7
255	65025	16581375	15.9687	6.3413	2.40654	3.92157	801.11	51070.5
256	65536	16777216	16.0000	6.3496	2.40824	3.90625	804.25	51471.9
257	66049	16974593	16.0312	6.3579	2.40993	3.89105	807.39	51874.8
258	66564	17173512	16.0624	6.3661	2.41162	3.87597	810.53	52279.2
259	67081	17373979	16.0935	6.3743	2.41330	3.86100	813.67	52685.3
260	67600	17576000	16.1245	6.3825	2.41497	3.84615	816.81	53092.9
261	68121	17779581	16.1555	6.3907	2.41664	3.83142	819.96	53502.1
262	68644	17984728	16.1864	6.3988	2.41830	3.81679	823.10	53912.6
263	69169	18191447	16.2173	6.4070	2.41996	3.80228	826.24	54325.2
264	69696	18399744	16.2481	6.4151	2.42160	3.78788	829.38	54739.1
265	70225	18609625	16.2788	6.4232	2.42325	3.77358	832.52	55154.6
266	70756	18821096	16.3095	6.4312	2.42488	3.75940	835.66	55571.6
267	71289	19034163	16.3401	6.4393	2.42651	3.74532	838.81	55990.2
268	71824	19248832	16.3707	6.4473	2.42813	3.73134	841.95	56410.4
269	72361	19465109	16.4012	6.4553	2.42975	3.71747	845.09	56832.2
270	72900	19683000	16.4317	6.4633	2.43136	3.70370	848.23	57255.5
271	73441	19902511	16.4621	6.4713	2.43297	3.69004	851.37	57680.4
272	73984	20123648	16.4924	6.4792	2.43457	3.67647	854.51	58106.9
273	74529	20346417	16.5227	6.4872	2.43616	3.66300	857.65	58534.9
274	75076	20570824	16.5529	6.4951	2.43775	3.64964	860.80	58964.6
275	75625	20796875	16.5831	6.5030	2.43933	3.63636	863.94	59395.7
276	76176	21024576	16.6132	6.5108	2.44091	3.62319	867.08	59828.5
277	76729	21253933	16.6433	6.5187	2.44248	3.61011	870.22	60262.8
278	77284	21484952	16.6733	6.5265	2.44404	3.59712	873.36	60698.7
279	77841	21717639	16.7033	6.5343	2.44560	3.58423	876.50	61136.2
280	78400	21952000	16.7332	6.5421	2.44716	3.57143	879.65	61575.2
281	78961	22188041	16.7631	6.5499	2.44871	3.55872	882.79	62015.8
282	79524	22425768	16.7929	6.5577	2.45025	3.54610	885.93	62458.0
283	80089	22665187	16.8226	6.5654	2.45179	3.53357	889.07	62901.8
284	80656	22906304	16.8523	6.5731	2.45332	3.52113	892.21	63347.1
285	81225	23149125	16.8819	6.5808	2.45484	3.50877	895.35	63794.0
286	81796	23393656	16.9115	6.5885	2.45637	3.49650	898.50	64242.4
287	82369	23639903	16.9411	6.5962	2.45788	3.48432	901.64	64692.5
288	82944	23887872	16.9706	6.6039	2.45939	3.47222	904.78	65144.1
289	83521	24137569	17.0000	6.6115	2.46090	3.46021	907.92	65597.2
290	84100	24389000	17.0294	6.6191	2.46240	3.44828	911.06	66052.0
291	84681	24642171	17.0587	6.6267	2.46389	3.43643	914.20	66508.3
292	85264	24897088	17.0880	6.6343	2.46538	3.42466	917.35	66966.2
293	85849	25153757	17.1172	6.6419	2.46687	3.41297	920.49	67425.6
294	86436	25412184	17.1464	6.6494	2.46835	3.40136	923.63	67886.7
295	87025	25672375	17.1756	6.6569	2.46982	3.38983	926.77	68349.3
296	87616	25934336	17.2047	6.6644	2.47129	3.37838	929.91	68813.4
297	88209	26198073	17.2337	6.6719	2.47276	3.36700	933.05	69279.2
298	88804	26463592	17.2627	6.6794	2.47422	3.35570	936.19	69746.5
299	89401	26730899	17.2916	6.6869	2.47567	3.34448	939.34	70215.4

FUNCTIONS OF NUMBERS

No.	Squares	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
300	90000	27000000	17.3205	5.6943	2.47712	3.33333	942.48	70685.8
301	90601	27270901	17.3494	5.7016	2.47857	3.32226	945.62	71157.9
302	91204	27543608	17.3781	5.7092	2.48001	3.31126	948.76	71631.5
303	91809	27818127	17.4069	5.7166	2.48144	3.30033	951.90	72106.6
304	92416	28094464	17.4356	5.7240	2.48287	3.28947	955.04	72583.4
305	93025	28372625	17.4642	5.7313	2.48430	3.27869	958.19	73061.7
306	93636	28652616	17.4929	5.7387	2.48572	3.26797	961.33	73541.5
307	94249	28934443	17.5214	5.7460	2.48714	3.25733	964.47	74023.0
308	94864	29218112	17.5499	5.7533	2.48855	3.24675	967.61	74506.0
309	95481	29503629	17.5784	5.7606	2.48996	3.23625	970.75	74990.6
310	96100	29791000	17.6068	5.7679	2.49136	3.22581	973.89	75476.8
311	96721	30080231	17.6352	5.7752	2.49276	3.21543	977.04	75964.5
312	97344	30371328	17.6635	5.7824	2.49415	3.20513	980.18	76453.8
313	97969	30664297	17.6918	5.7897	2.49554	3.19489	983.32	76944.7
314	98596	30959144	17.7200	5.7969	2.49693	3.18471	986.46	77437.1
315	99225	31255875	17.7482	5.8041	2.49831	3.17460	989.60	77931.1
316	99856	31554496	17.7764	5.8113	2.49969	3.16456	992.74	78426.7
317	100489	31855013	17.8045	5.8185	2.50106	3.15457	995.88	78923.9
318	101124	32157432	17.8326	5.8256	2.50243	3.14465	999.03	79422.6
319	101761	32461759	17.8606	5.8328	2.50379	3.13480	1002.2	79922.9
320	102400	32768000	17.8885	5.8399	2.50515	3.12500	1005.3	80424.8
321	103041	33076161	17.9165	5.8470	2.50651	3.11526	1008.5	80928.2
322	103684	33386248	17.9444	5.8541	2.50786	3.10559	1011.6	81433.2
323	104329	33698267	17.9722	5.8612	2.50920	3.09598	1014.7	81939.8
324	104976	34012224	18.0000	5.8683	2.51055	3.08642	1017.9	82448.0
325	105625	34328125	18.0278	5.8753	2.51188	3.07692	1021.0	82957.7
326	106276	34645976	18.0556	5.8824	2.51322	3.06749	1024.2	83469.0
327	106929	34965783	18.0831	5.8894	2.51455	3.05810	1027.3	83981.8
328	107584	35287552	18.1108	5.8964	2.51587	3.04878	1030.4	84496.3
329	108241	35611289	18.1384	5.9034	2.51720	3.03951	1033.6	85012.3
330	108900	35937000	18.1659	5.9104	2.51851	3.03030	1036.7	85529.9
331	109561	36264691	18.1934	5.9174	2.51983	3.02115	1039.9	86049.0
332	110224	36594368	18.2209	5.9244	2.52114	3.01205	1043.0	86569.7
333	110889	36926037	18.2483	5.9313	2.52244	3.00300	1046.2	87092.0
334	111556	37259704	18.2757	5.9382	2.52375	2.99401	1049.3	87615.9
335	112225	37595375	18.3030	5.9451	2.52504	2.98507	1052.4	88141.3
336	112896	37933056	18.3303	5.9521	2.52634	2.97619	1055.6	88668.3
337	113569	38272753	18.3576	5.9589	2.52763	2.96736	1058.7	89196.9
338	114244	38614472	18.3848	5.9658	2.52892	2.95858	1061.9	89727.0
339	114921	38958219	18.4120	5.9727	2.53020	2.94985	1065.0	90258.7
340	115600	39304000	18.4391	5.9796	2.53148	2.94118	1068.1	90792.0
341	116281	39651821	18.4662	5.9864	2.53275	2.93255	1071.3	91326.9
342	116964	40001688	18.4932	5.9932	2.53403	2.92398	1074.4	91863.3
343	117649	40353607	18.5203	7.0000	2.53529	2.91545	1077.6	92401.3
344	118336	40707584	18.5472	7.0068	2.53656	2.90698	1080.7	92940.9
345	119025	41063625	18.5742	7.0136	2.53782	2.89855	1083.8	93482.0
346	119716	41421736	18.6011	7.0203	2.53908	2.89017	1087.0	94024.7
347	120409	41781923	18.6279	7.0271	2.54033	2.88184	1090.1	94569.0
348	121104	42144192	18.6548	7.0338	2.54158	2.87356	1093.3	95114.9
349	121801	42508549	18.6815	7.0406	2.54283	2.86533	1096.4	95662.3

FUNCTIONS OF NUMBERS

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No.	Squers	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. — Diameter	
							Circum.	Area
350	122500	42875000	18.7063	7.0473	2.54407	2.85714	1099.6	96211.3
351	123201	43243551	18.7350	7.0540	2.54531	2.84900	1102.7	96761.8
352	123904	43614208	18.7617	7.0607	2.54654	2.84091	1105.8	97314.0
353	124609	43986977	18.7883	7.0674	2.54777	2.83286	1109.0	97867.7
354	125316	44361864	18.8149	7.0740	2.54900	2.82486	1112.1	98423.0
355	126025	44738875	18.8414	7.0807	2.55023	2.81690	1115.3	98979.8
356	126736	45118016	18.8680	7.0873	2.55145	2.80899	1118.4	99538.2
357	127449	45499293	18.8944	7.0940	2.55267	2.80112	1121.5	100096
358	128164	45882712	18.9209	7.1006	2.55388	2.79330	1124.7	100660
359	128881	46268279	18.9473	7.1072	2.55509	2.78552	1127.8	101223
360	129600	46656000	18.9737	7.1138	2.55630	2.77778	1131.0	101788
361	130321	47045881	19.0000	7.1204	2.55751	2.77008	1134.1	102354
362	131044	47437928	19.0263	7.1269	2.55871	2.76243	1137.3	102922
363	131769	47832147	19.0526	7.1335	2.55991	2.75482	1140.4	103491
364	132496	48228544	19.0788	7.1400	2.56110	2.74725	1143.5	104062
365	133225	48627125	19.1050	7.1466	2.56229	2.73973	1146.7	104635
366	133956	49027896	19.1311	7.1531	2.56348	2.73224	1149.8	105209
367	134689	49430863	19.1572	7.1596	2.56467	2.72480	1153.0	105785
368	135424	49836032	19.1833	7.1661	2.56585	2.71739	1156.1	106362
369	136161	50243409	19.2094	7.1726	2.56703	2.71003	1159.2	106941
370	136900	50653000	19.2354	7.1791	2.56820	2.70270	1162.4	107521
371	137641	51064811	19.2614	7.1856	2.56937	2.69542	1165.5	108103
372	138384	51478948	19.2873	7.1920	2.57054	2.68817	1168.7	108687
373	139129	51895117	19.3132	7.1984	2.57171	2.68097	1171.8	109272
374	139876	52313624	19.3391	7.2048	2.57287	2.67380	1175.0	109858
375	140625	52734375	19.3649	7.2112	2.57403	2.66676	1178.1	110447
376	141376	53157376	19.3907	7.2177	2.57519	2.65975	1181.2	111036
377	142129	53582633	19.4165	7.2240	2.57634	2.65272	1184.4	111628
378	142884	54010152	19.4422	7.2304	2.57749	2.64570	1187.5	112221
379	143641	54439939	19.4679	7.2368	2.57864	2.63862	1190.7	112815
380	144400	54872000	19.4936	7.2432	2.57979	2.63158	1193.8	113411
381	145161	55306341	19.5192	7.2495	2.58093	2.62457	1196.9	114009
382	145924	55742968	19.5448	7.2558	2.58206	2.61759	1200.1	114608
383	146689	56181887	19.5704	7.2622	2.58320	2.61067	1203.2	115209
384	147456	56623104	19.5959	7.2685	2.58433	2.60371	1206.4	115812
385	148225	57066625	19.6214	7.2748	2.58546	2.59674	1209.5	116416
386	148996	57512456	19.6469	7.2811	2.58659	2.58976	1212.7	117021
387	149769	57960603	19.6723	7.2874	2.58771	2.58280	1215.8	117628
388	150544	58411072	19.6977	7.2936	2.58883	2.57582	1218.9	118237
389	151321	58863869	19.7231	7.2999	2.58995	2.57069	1222.1	118847
390	152100	59319000	19.7484	7.3061	2.59106	2.56510	1225.2	119459
391	152881	59776471	19.7737	7.3124	2.59218	2.55954	1228.4	120072
392	153664	60236288	19.7990	7.3186	2.59329	2.55402	1231.5	120687
393	154449	60698457	19.8242	7.3248	2.59439	2.54853	1234.6	121304
394	155236	61162984	19.8494	7.3310	2.59550	2.54307	1237.8	121922
395	156025	61629875	19.8746	7.3372	2.59660	2.53765	1240.9	122542
396	156816	62099136	19.8997	7.3434	2.59770	2.53225	1244.1	123163
397	157609	62570773	19.9249	7.3496	2.59879	2.52689	1247.2	123785
398	158404	63044792	19.9499	7.3558	2.59988	2.52156	1250.4	124410
399	159201	63521199	19.9750	7.3619	2.60097	2.51627	1253.5	125036

FUNCTIONS OF NUMBERS

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
400	160000	64000000	20.0000	7.3681	2.60206	2.50000	1256.6	125664
401	160601	64481201	20.0250	7.3742	2.60314	2.49377	1259.8	126293
402	161604	64964808	20.0499	7.3803	2.60423	2.48756	1262.9	126923
403	162409	65450827	20.0749	7.3864	2.60531	2.48139	1266.1	127556
404	163216	65939264	20.0998	7.3925	2.60638	2.47525	1269.2	128190
405	164025	66430125	20.1248	7.3986	2.60746	2.46914	1272.3	128825
406	164836	66923416	20.1494	7.4047	2.60853	2.46306	1275.5	129462
407	165649	67419143	20.1742	7.4108	2.60959	2.45700	1278.6	130100
408	166464	67917312	20.1990	7.4169	2.61066	2.45098	1281.8	130741
409	167281	68417929	20.2237	7.4229	2.61172	2.44499	1284.9	131382
410	168100	68921000	20.2485	7.4290	2.61278	2.43902	1288.1	132025
411	168921	69426531	20.2731	7.4350	2.61384	2.43309	1291.2	132670
412	169744	69934528	20.2978	7.4410	2.61490	2.42718	1294.3	133317
413	170569	70444997	20.3224	7.4470	2.61595	2.42131	1297.5	133965
414	171396	70957944	20.3470	7.4530	2.61700	2.41546	1300.6	134614
415	172225	71473375	20.3715	7.4590	2.61805	2.40964	1303.8	135265
416	173056	71991290	20.3961	7.4650	2.61909	2.40385	1306.9	135918
417	173889	72511713	20.4206	7.4710	2.62014	2.39808	1310.0	136572
418	174724	73034632	20.4450	7.4770	2.62118	2.39234	1313.2	137228
419	175561	73560069	20.4695	7.4829	2.62221	2.38663	1316.3	137885
420	176400	74088000	20.4939	7.4889	2.62325	2.38095	1319.5	138544
421	177241	74618461	20.5183	7.4948	2.62428	2.37530	1322.6	139205
422	178084	75151448	20.5426	7.5007	2.62531	2.36967	1325.8	139867
423	178929	75686967	20.5670	7.5067	2.62634	2.36407	1328.9	140531
424	179776	76225024	20.5913	7.5126	2.62737	2.35849	1332.0	141196
425	180625	76765625	20.6155	7.5185	2.62839	2.35294	1335.2	141863
426	181476	77308776	20.6398	7.5244	2.62941	2.34742	1338.3	142531
427	182329	77854483	20.6640	7.5302	2.63043	2.34192	1341.5	143201
428	183184	78402752	20.6882	7.5361	2.63144	2.33645	1344.6	143872
429	184041	78953589	20.7123	7.5420	2.63246	2.33100	1347.7	144545
430	184900	79507000	20.7364	7.5478	2.63347	2.32558	1350.9	145220
431	185761	80062991	20.7605	7.5537	2.63448	2.32019	1354.0	145896
432	186624	80621568	20.7846	7.5595	2.63548	2.31481	1357.2	146574
433	187489	81182737	20.8087	7.5654	2.63649	2.30947	1360.3	147254
434	188356	81746504	20.8327	7.5712	2.63749	2.30415	1363.5	147934
435	189225	82312875	20.8567	7.5770	2.63849	2.29885	1366.6	148617
436	190096	82881856	20.8806	7.5828	2.63949	2.29358	1369.7	149301
437	190969	83453463	20.9045	7.5886	2.64048	2.28833	1372.9	149987
438	191844	84027672	20.9284	7.5944	2.64147	2.28311	1376.0	150674
439	192721	84604519	20.9523	7.6001	2.64246	2.27790	1379.2	151363
440	193600	85184000	20.9762	7.6059	2.64345	2.27273	1382.3	152053
441	194481	85766121	21.0000	7.6117	2.64444	2.26757	1385.4	152745
442	195364	86350888	21.0238	7.6174	2.64542	2.26244	1388.6	153439
443	196249	86938307	21.0476	7.6232	2.64640	2.25734	1391.7	154134
444	197136	87528384	21.0713	7.6289	2.64738	2.25225	1394.9	154830
445	198025	88121125	21.0950	7.6346	2.64836	2.24719	1398.0	155528
446	198916	88716536	21.1187	7.6403	2.64933	2.24216	1401.2	156228
447	199809	89314623	21.1424	7.6460	2.65031	2.23714	1404.3	156930
448	200704	89915392	21.1660	7.6517	2.65128	2.23214	1407.4	157633
449	201601	90518849	21.1896	7.6574	2.65225	2.22717	1410.6	158337

FUNCTIONS OF NUMBERS

450

499

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
450	202500	91125000	21.2132	7.6631	2.65321	2.22222	1413.7	159043
451	203401	91733851	21.2368	7.6688	2.65418	2.21729	1416.9	159751
452	204304	92345408	21.2603	7.6744	2.65514	2.21239	1420.0	160460
453	205209	92959677	21.2838	7.6801	2.65610	2.20751	1423.1	161171
454	206116	93576664	21.3073	7.6857	2.65706	2.20264	1426.3	161883
455	207025	94196375	21.3307	7.6914	2.65801	2.19780	1429.4	162597
456	207936	94818816	21.3542	7.6970	2.65896	2.19298	1432.6	163313
457	208849	95444393	21.3776	7.7026	2.65992	2.18818	1435.7	164030
458	209764	96071912	21.4009	7.7082	2.66087	2.18341	1438.8	164748
459	210681	96702579	21.4243	7.7138	2.66181	2.17865	1442.0	165468
460	211600	97336000	21.4476	7.7194	2.66276	2.17391	1445.1	166190
461	212521	97972181	21.4709	7.7250	2.66370	2.16920	1448.3	166914
462	213444	98611128	21.4942	7.7306	2.66464	2.16450	1451.4	167639
463	214369	99252847	21.5174	7.7362	2.66558	2.15983	1454.6	168365
464	215296	99897344	21.5407	7.7418	2.66652	2.15517	1457.7	169093
465	216225	100544625	21.5639	7.7473	2.66745	2.15054	1460.8	169823
466	217156	101194696	21.5870	7.7529	2.66839	2.14592	1464.0	170554
467	218089	101847563	21.6102	7.7584	2.66932	2.14133	1467.1	171287
468	219024	102503232	21.6333	7.7639	2.67025	2.13675	1470.3	172021
469	219961	103161709	21.6564	7.7695	2.67117	2.13220	1473.4	172757
470	220900	103823000	21.6795	7.7750	2.67210	2.12766	1476.5	173494
471	221841	104487111	21.7025	7.7805	2.67302	2.12314	1479.7	174234
472	222784	105154048	21.7256	7.7860	2.67394	2.11864	1482.8	174974
473	223729	105823817	21.7486	7.7915	2.67486	2.11416	1486.0	175716
474	224676	106496424	21.7715	7.7970	2.67578	2.10970	1489.1	176460
475	225625	107171875	21.7945	7.8025	2.67669	2.10526	1492.3	177205
476	226576	107850176	21.8174	7.8079	2.67761	2.10084	1495.4	177952
477	227529	108531333	21.8403	7.8134	2.67852	2.09644	1498.5	178701
478	228484	109215352	21.8632	7.8188	2.67943	2.09205	1501.7	179451
479	229441	109902239	21.8861	7.8243	2.68034	2.08768	1504.8	180203
480	230400	110592000	21.9089	7.8297	2.68124	2.08333	1508.0	180956
481	231361	111284641	21.9317	7.8352	2.68215	2.07900	1511.1	181711
482	232324	111980168	21.9545	7.8406	2.68305	2.07469	1514.2	182467
483	233289	112678587	21.9773	7.8460	2.68395	2.07039	1517.4	183225
484	234256	113379904	22.0000	7.8514	2.68485	2.06612	1520.5	183984
485	235225	114084125	22.0227	7.8568	2.68574	2.06186	1523.7	184745
486	236196	114791256	22.0454	7.8622	2.68664	2.05761	1526.8	185508
487	237169	115501303	22.0681	7.8676	2.68753	2.05339	1530.0	186272
488	238144	116214272	22.0907	7.8730	2.68842	2.04918	1533.1	187038
489	239121	116930169	22.1133	7.8784	2.68931	2.04499	1536.2	187805
490	240100	117649000	22.1359	7.8837	2.69020	2.04082	1539.4	188574
491	241081	118370771	22.1585	7.8891	2.69108	2.03666	1542.5	189345
492	242064	119095488	22.1811	7.8944	2.69197	2.03252	1545.7	190117
493	243049	119823157	22.2036	7.8998	2.69285	2.02840	1548.8	190890
494	244036	120553784	22.2261	7.9051	2.69373	2.02429	1551.9	191665
495	245025	121287375	22.2486	7.9105	2.69461	2.02020	1555.1	192442
496	246016	122023936	22.2711	7.9158	2.69548	2.01613	1558.2	193221
497	247009	122763473	22.2935	7.9211	2.69636	2.01207	1561.4	194000
498	248004	123505992	22.3159	7.9264	2.69723	2.00803	1564.5	194782
499	249001	124251499	22.3383	7.9317	2.69810	2.00401	1567.7	195565

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

FUNCTIONS OF NUMBERS

No.	Squares	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
500	250000	125000000	22.3607	7.9370	2.69897	2.00000	1570.8	196350
501	251001	125751501	22.3830	7.9423	2.69984	1.99901	1573.9	197136
502	252004	126506008	22.4054	7.9476	2.70070	1.99203	1577.1	197923
503	253009	127263527	22.4277	7.9528	2.70157	1.98807	1580.2	198713
504	254016	128024064	22.4499	7.9581	2.70243	1.98413	1583.4	199504
505	255025	128787625	22.4722	7.9634	2.70329	1.98020	1586.5	200296
506	256036	129554216	22.4944	7.9686	2.70415	1.97628	1589.6	201090
507	257049	130323843	22.5167	7.9739	2.70501	1.97235	1592.8	201886
508	258064	131096512	22.5389	7.9791	2.70586	1.96850	1595.9	202683
509	259081	131872229	22.5610	7.9843	2.70672	1.96464	1599.1	203482
510	260100	132651000	22.5832	7.9896	2.70757	1.96078	1602.2	204282
511	261121	133432831	22.6053	7.9948	2.70842	1.95695	1605.4	205084
512	262144	134217728	22.6274	8.0000	2.70927	1.95312	1608.5	205887
513	263169	135005697	22.6496	8.0052	2.71012	1.94932	1611.6	206692
514	264196	135796744	22.6718	8.0104	2.71096	1.94553	1614.8	207499
515	265225	136590875	22.6936	8.0156	2.71181	1.94175	1617.9	208307
516	266256	137388006	22.7156	8.0208	2.71265	1.93798	1621.1	209117
517	267289	138188413	22.7376	8.0260	2.71349	1.93424	1624.2	209928
518	268324	138991832	22.7596	8.0311	2.71433	1.93050	1627.3	210741
519	269361	139798359	22.7816	8.0363	2.71517	1.92678	1630.5	211556
520	270400	140608000	22.8035	8.0415	2.71600	1.92308	1633.6	212372
521	271441	141420761	22.8254	8.0468	2.71684	1.91939	1636.8	213189
522	272484	142236648	22.8473	8.0517	2.71767	1.91571	1639.9	214008
523	273529	143055667	22.8692	8.0569	2.71850	1.91206	1643.1	214829
524	274576	143877824	22.8910	8.0620	2.71933	1.90840	1646.2	215651
525	275625	144703125	22.9129	8.0671	2.72016	1.90476	1649.3	216475
526	276676	145531576	22.9347	8.0723	2.72099	1.90114	1652.5	217301
527	277729	146363183	22.9565	8.0774	2.72181	1.89753	1655.6	218128
528	278784	147197952	22.9783	8.0825	2.72263	1.89394	1658.8	218956
529	279841	148035889	23.0000	8.0876	2.72346	1.89036	1661.9	219787
530	280900	148877000	23.0217	8.0927	2.72428	1.88679	1665.0	220618
531	281961	149721291	23.0434	8.0978	2.72509	1.88324	1668.2	221452
532	283024	150568768	23.0651	8.1028	2.72591	1.87970	1671.3	222289
533	284089	151419437	23.0868	8.1079	2.72673	1.87617	1674.5	223123
534	285156	152273304	23.1084	8.1130	2.72754	1.87266	1677.6	223961
535	286225	153130375	23.1301	8.1180	2.72835	1.86916	1680.8	224801
536	287296	153990656	23.1517	8.1231	2.72916	1.86567	1683.9	225642
537	288369	154854153	23.1733	8.1281	2.72997	1.86220	1687.0	226484
538	289444	155720872	23.1948	8.1332	2.73078	1.85874	1690.2	227329
539	290521	156590819	23.2164	8.1382	2.73159	1.85529	1693.3	228175
540	291600	157464000	23.2379	8.1433	2.73239	1.85185	1696.5	229022
541	292681	158340421	23.2594	8.1483	2.73320	1.84843	1699.6	229871
542	293764	159220088	23.2809	8.1533	2.73400	1.84502	1702.7	230722
543	294849	160103007	23.3024	8.1583	2.73480	1.84162	1705.9	231574
544	295936	160989184	23.3238	8.1633	2.73560	1.83824	1709.0	232428
545	297025	161878625	23.3452	8.1683	2.73640	1.83486	1712.2	233283
546	298116	162771336	23.3666	8.1733	2.73719	1.83150	1715.3	234140
547	299209	163667323	23.3880	8.1783	2.73799	1.82815	1718.5	234998
548	300304	164566592	23.4094	8.1833	2.73878	1.82482	1721.6	235858
549	301401	165469149	23.4307	8.1882	2.73957	1.82149	1724.7	236720

FUNCTIONS OF NUMBERS

550

599

No.	Squares	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
550	302500	166375000	23.4521	8.1932	2.74036	1.81818	1727.9	237583
551	303601	167284151	23.4734	8.1962	2.74115	1.81488	1731.0	238448
552	304704	168196508	23.4947	8.2031	2.74194	1.81159	1734.2	239314
553	305809	169112377	23.5160	8.2081	2.74273	1.80832	1737.3	240182
554	306916	170031464	23.5372	8.2130	2.74351	1.80505	1740.4	241051
555	308025	170953875	23.5584	8.2180	2.74429	1.80180	1743.6	241922
556	309136	171879616	23.5797	8.2229	2.74507	1.79856	1746.7	242795
557	310249	172808693	23.6008	8.2278	2.74586	1.79533	1749.9	243669
558	311364	173741112	23.6220	8.2327	2.74663	1.79211	1753.0	244545
559	312481	174676879	23.6432	8.2377	2.74741	1.78891	1756.2	245422
560	313600	175616000	23.6643	8.2426	2.74819	1.78571	1759.3	246301
561	314721	176558481	23.6854	8.2475	2.74896	1.78253	1762.4	247181
562	315844	177504328	23.7065	8.2524	2.74974	1.77936	1765.6	248063
563	316969	178453547	23.7276	8.2573	2.75051	1.77620	1768.7	248947
564	318096	179406144	23.7487	8.2621	2.75128	1.77305	1771.9	249832
565	319225	180362125	23.7697	8.2670	2.75205	1.76991	1775.0	250719
566	320356	181321496	23.7908	8.2719	2.75282	1.76678	1778.1	251607
567	321489	182284263	23.8118	8.2768	2.75358	1.76367	1781.3	252497
568	322624	183250432	23.8328	8.2816	2.75435	1.76056	1784.4	253388
569	323761	184220009	23.8537	8.2865	2.75511	1.75747	1787.6	254281
570	324900	185193000	23.8747	8.2913	2.75587	1.75439	1790.7	255176
571	326041	186169411	23.8956	8.2962	2.75664	1.75131	1793.8	256072
572	327184	187149248	23.9165	8.3010	2.75740	1.74825	1797.0	256970
573	328329	188132517	23.9374	8.3059	2.75815	1.74520	1800.1	257869
574	329476	189119224	23.9583	8.3107	2.75891	1.74216	1803.3	258770
575	330625	190109375	23.9792	8.3156	2.75967	1.73913	1806.4	259672
576	331776	191102976	24.0000	8.3203	2.76042	1.73611	1809.6	260576
577	332929	192100033	24.0208	8.3251	2.76118	1.73310	1812.7	261482
578	334084	193100552	24.0416	8.3300	2.76193	1.73010	1815.8	262389
579	335241	194104539	24.0624	8.3348	2.76268	1.72712	1819.0	263298
580	336400	195112000	24.0832	8.3396	2.76343	1.72414	1822.1	264208
581	337561	196122941	24.1039	8.3444	2.76418	1.72117	1825.3	265120
582	338724	197137368	24.1247	8.3491	2.76492	1.71821	1828.4	266033
583	339889	198155287	24.1454	8.3539	2.76567	1.71527	1831.6	266948
584	341056	199176704	24.1661	8.3587	2.76641	1.71233	1834.7	267865
585	342225	200201625	24.1868	8.3634	2.76716	1.70940	1837.8	268783
586	343396	201230056	24.2074	8.3682	2.76790	1.70648	1841.0	269703
587	344569	202262003	24.2281	8.3730	2.76864	1.70358	1844.1	270624
588	345744	203297472	24.2487	8.3777	2.76938	1.70068	1847.3	271547
589	346921	204336469	24.2693	8.3825	2.77012	1.69779	1850.4	272471
590	348100	205379000	24.2899	8.3872	2.77086	1.69492	1853.5	273397
591	349281	206425071	24.3105	8.3919	2.77159	1.69206	1856.7	274325
592	350464	207474688	24.3311	8.3967	2.77232	1.68921	1859.8	275254
593	351649	208527857	24.3516	8.4014	2.77305	1.68634	1863.0	276184
594	352836	209584584	24.3721	8.4061	2.77379	1.68350	1866.1	277117
595	354025	210644875	24.3926	8.4108	2.77452	1.68067	1869.2	278051
596	355216	211708736	24.4131	8.4155	2.77525	1.67785	1872.4	278986
597	356409	212776177	24.4336	8.4202	2.77597	1.67504	1875.5	279923
598	357604	213847192	24.4540	8.4249	2.77670	1.67224	1878.7	280862
599	358801	214921799	24.4745	8.4296	2.77743	1.66945	1881.8	281802

FUNCTIONS OF NUMBERS

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
600	360000	216000000	24.4949	8.4343	2.77815	1.66667	1885.0	282743
601	361201	217081801	24.5153	8.4350	2.77887	1.66389	1888.1	283687
602	362404	218167208	24.5357	8.4437	2.77960	1.66113	1891.2	284631
603	363609	219256227	24.5561	8.4484	2.78032	1.65837	1894.4	285578
604	364816	220348864	24.5764	8.4530	2.78104	1.65563	1897.5	286526
605	366025	221445125	24.5967	8.4577	2.78176	1.65289	1900.7	287475
606	367236	222545016	24.6171	8.4623	2.78247	1.65017	1903.8	288426
607	368449	223648543	24.6374	8.4670	2.78319	1.64745	1906.9	289379
608	369664	224755712	24.6577	8.4716	2.78390	1.64474	1910.1	290333
609	370881	225866529	24.6779	8.4763	2.78462	1.64204	1913.2	291289
610	372100	226981000	24.6982	8.4809	2.78533	1.63934	1916.4	292247
611	373321	228099131	24.7184	8.4856	2.78604	1.63666	1919.5	293206
612	374544	229220928	24.7386	8.4902	2.78675	1.63399	1922.7	294166
613	375769	230346397	24.7588	8.4948	2.78746	1.63132	1925.8	295128
614	376996	231475544	24.7790	8.4994	2.78817	1.62866	1928.9	296092
615	378225	232608375	24.7992	8.5040	2.78888	1.62602	1932.1	297057
616	379456	233744896	24.8193	8.5086	2.78958	1.62338	1935.2	298024
617	380689	234885113	24.8395	8.5132	2.79029	1.62075	1938.4	298992
618	381924	236029032	24.8596	8.5178	2.79099	1.61812	1941.5	299962
619	383161	237176659	24.8797	8.5224	2.79169	1.61551	1944.6	300934
620	384400	238328000	24.8998	8.5270	2.79239	1.61290	1947.8	301907
621	385641	239483061	24.9199	8.5316	2.79309	1.61031	1950.9	302882
622	386884	240641848	24.9399	8.5362	2.79379	1.60772	1954.1	303858
623	388129	241804367	24.9600	8.5408	2.79449	1.60514	1957.2	304836
624	389376	242970624	24.9800	8.5453	2.79518	1.60256	1960.4	305815
625	390625	244140625	25.0000	8.5499	2.79588	1.60000	1963.5	306796
626	391876	245314376	25.0200	8.5544	2.79657	1.59744	1966.6	307779
627	393129	246491883	25.0400	8.5590	2.79727	1.59490	1969.8	308763
628	394384	247673152	25.0599	8.5635	2.79796	1.59236	1972.9	309748
629	395641	248858189	25.0799	8.5681	2.79865	1.58983	1976.1	310736
630	396900	250047000	25.0998	8.5726	2.79934	1.58730	1979.2	311725
631	398161	251239591	25.1197	8.5772	2.80003	1.58479	1982.3	312715
632	399424	252435968	25.1396	8.5817	2.80072	1.58228	1985.5	313707
633	400689	253636137	25.1595	8.5862	2.80140	1.57978	1988.6	314700
634	401956	254840104	25.1794	8.5907	2.80209	1.57729	1991.8	315696
635	403225	256047875	25.1992	8.5952	2.80277	1.57480	1994.9	316692
636	404496	257259456	25.2190	8.5997	2.80346	1.57233	1998.1	317690
637	405769	258474853	25.2389	8.6043	2.80414	1.56986	2001.2	318690
638	407044	259694072	25.2587	8.6088	2.80482	1.56740	2004.3	319692
639	408321	260917119	25.2784	8.6132	2.80550	1.56495	2007.5	320696
640	409600	262144000	25.2982	8.6177	2.80618	1.56250	2010.6	321699
641	410881	263374721	25.3180	8.6222	2.80686	1.56006	2013.8	322705
642	412164	264609288	25.3377	8.6267	2.80754	1.55763	2016.9	323713
643	413449	265847707	25.3574	8.6312	2.80821	1.55521	2020.0	324722
644	414736	267089984	25.3772	8.6357	2.80889	1.55280	2023.2	325733
645	416025	268336125	25.3969	8.6401	2.80956	1.55039	2026.3	326745
646	417316	269586136	25.4165	8.6446	2.81023	1.54799	2029.5	327759
647	418609	270840023	25.4362	8.6490	2.81090	1.54560	2032.6	328775
648	419904	272097792	25.4558	8.6535	2.81158	1.54321	2035.8	329792
649	421201	273359449	25.4755	8.6579	2.81224	1.54083	2038.9	330810

FUNCTIONS OF NUMBERS

650

699

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
650	422500	274625000	25.4951	8.6624	2.81291	1.53846	2042.0	331831
651	423801	275894451	25.5147	8.6668	2.81358	1.53610	2045.2	332853
652	425104	277167808	25.5343	8.6713	2.81425	1.53374	2048.3	333876
653	426409	278445077	25.5539	8.6757	2.81491	1.53139	2051.5	334901
654	427716	279726264	25.5734	8.6801	2.81558	1.52905	2054.6	335927
655	429025	281011375	25.5930	8.6845	2.81624	1.52672	2057.7	336955
656	430336	282300416	25.6125	8.6889	2.81690	1.52439	2060.9	337985
657	431649	283593393	25.6320	8.6934	2.81757	1.52207	2064.0	339016
658	432964	284890312	25.6515	8.6978	2.81823	1.51976	2067.2	340049
659	434281	286191179	25.6710	8.7022	2.81889	1.51745	2070.3	341084
660	435600	287496000	25.6905	8.7066	2.81954	1.51515	2073.5	342119
661	436921	288804781	25.7099	8.7110	2.82020	1.51286	2076.6	343157
662	438244	290117526	25.7294	8.7154	2.82086	1.51057	2079.7	344196
663	439569	291434247	25.7488	8.7198	2.82151	1.50830	2082.9	345237
664	440896	292754944	25.7682	8.7241	2.82217	1.50602	2086.0	346279
665	442225	294079625	25.7876	8.7285	2.82282	1.50376	2089.2	347323
666	443556	295408296	25.8070	8.7329	2.82347	1.50150	2092.3	348368
667	444889	296740963	25.8263	8.7373	2.82413	1.49925	2095.4	349415
668	446224	298077632	25.8457	8.7416	2.82478	1.49701	2098.5	350464
669	447561	299418309	25.8650	8.7460	2.82543	1.49477	2101.7	351514
670	448900	300763000	25.8844	8.7503	2.82607	1.49254	2104.9	352565
671	450241	302111711	25.9037	8.7547	2.82672	1.49031	2108.0	353618
672	451584	303464448	25.9230	8.7590	2.82737	1.48810	2111.2	354673
673	452929	304821217	25.9422	8.7634	2.82802	1.48588	2114.3	355730
674	454276	306182024	25.9615	8.7677	2.82866	1.48368	2117.4	356788
675	455625	307546875	25.9808	8.7721	2.82930	1.48148	2120.6	357847
676	456976	308915776	26.0000	8.7764	2.82995	1.47929	2123.7	358908
677	458329	310288733	26.0192	8.7807	2.83059	1.47710	2126.9	359971
678	459684	311665752	26.0384	8.7850	2.83123	1.47493	2130.0	361035
679	461041	313046839	26.0576	8.7893	2.83187	1.47275	2133.1	362101
680	462400	314432000	26.0768	8.7937	2.83251	1.47059	2136.3	363168
681	463761	315821241	26.0960	8.7980	2.83315	1.46843	2139.4	364237
682	465124	317214568	26.1151	8.8023	2.83378	1.46628	2142.6	365308
683	466489	318611987	26.1343	8.8066	2.83442	1.46413	2145.7	366380
684	467856	320013504	26.1534	8.8109	2.83506	1.46199	2148.8	367453
685	469225	321419125	26.1725	8.8152	2.83569	1.45985	2152.0	368528
686	470596	322828866	26.1916	8.8194	2.83632	1.45773	2155.1	369605
687	471969	324242703	26.2107	8.8237	2.83696	1.45560	2158.3	370684
688	473344	325660672	26.2298	8.8280	2.83759	1.45349	2161.4	371764
689	474721	327082769	26.2488	8.8323	2.83822	1.45138	2164.6	372845
690	476100	328509000	26.2679	8.8366	2.83885	1.44928	2167.7	373928
691	477481	329939371	26.2869	8.8408	2.83948	1.44718	2170.8	375013
692	478864	331373888	26.3059	8.8451	2.84011	1.44509	2174.0	376099
693	480249	332812557	26.3249	8.8493	2.84073	1.44300	2177.1	377187
694	481636	334255384	26.3439	8.8536	2.84136	1.44092	2180.3	378276
695	483025	335702375	26.3629	8.8578	2.84199	1.43885	2183.4	379367
696	484416	337153536	26.3818	8.8621	2.84261	1.43678	2186.5	380459
697	485809	338608873	26.4008	8.8663	2.84323	1.43472	2189.7	381553
698	487204	340068392	26.4197	8.8706	2.84386	1.43266	2192.8	382649
699	488601	341532099	26.4386	8.8748	2.84448	1.43062	2196.0	383746

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

700
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FUNCTIONS OF NUMBERS

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Girth	Area
700	490000	343000000	26.4575	8.8790	2.84510	1.42657	2199.1	394845
701	491401	344472101	26.4764	8.8833	2.84572	1.42653	2202.3	395045
702	492804	345948408	26.4953	8.8875	2.84634	1.42649	2205.4	395247
703	494200	347428927	26.5141	8.8917	2.84696	1.42645	2208.5	395451
704	495516	348913664	26.5330	8.8959	2.84757	1.42641	2211.7	395656
705	497025	350402625	26.5518	8.9001	2.84819	1.41844	2214.8	395863
706	498436	351895816	26.5707	8.9043	2.84880	1.41643	2218.0	396071
707	499849	353393243	26.5895	8.9085	2.84942	1.41443	2221.1	396280
708	501264	354894912	26.6083	8.9127	2.85003	1.41243	2224.2	396489
709	502681	356400829	26.6271	8.9169	2.85065	1.41044	2227.4	396698
710	504100	357911000	26.6458	8.9211	2.85126	1.40845	2230.5	396919
711	505521	359425431	26.6646	8.9253	2.85187	1.40647	2233.7	397135
712	506944	360944128	26.6833	8.9295	2.85248	1.40448	2236.8	397353
713	508369	362467097	26.7021	8.9337	2.85309	1.40250	2240.0	397572
714	509796	363994344	26.7208	8.9378	2.85370	1.40052	2243.1	397793
715	511225	365525875	26.7395	8.9420	2.85431	1.39853	2246.2	398015
716	512656	367061696	26.7582	8.9462	2.85491	1.39655	2249.4	398239
717	514089	368601813	26.7769	8.9503	2.85552	1.39457	2252.5	398465
718	515524	370146232	26.7955	8.9545	2.85612	1.39259	2255.7	398692
719	516961	371694959	26.8142	8.9587	2.85673	1.39062	2258.8	398920
720	518400	373248000	26.8328	8.9628	2.85733	1.38865	2261.9	399150
721	519841	374806361	26.8514	8.9670	2.85794	1.38668	2265.1	399382
722	521284	376367048	26.8701	8.9711	2.85854	1.38471	2268.2	399615
723	522729	377931067	26.8887	8.9752	2.85914	1.38274	2271.4	399850
724	524176	379500424	26.9072	8.9794	2.85974	1.38077	2274.5	400087
725	525625	381075125	26.9258	8.9835	2.86034	1.37880	2277.7	400325
726	527076	382655176	26.9444	8.9876	2.86094	1.37683	2280.8	400565
727	528529	384240583	26.9629	8.9918	2.86153	1.37486	2283.9	400806
728	529984	385831352	26.9815	8.9959	2.86213	1.37289	2287.1	401048
729	531441	387427489	27.0000	9.0000	2.86273	1.37092	2290.2	401291
730	532900	389029000	27.0185	9.0041	2.86332	1.36895	2293.4	401535
731	534361	390636781	27.0370	9.0082	2.86392	1.36698	2296.5	401780
732	535824	392250832	27.0555	9.0123	2.86451	1.36501	2299.6	402026
733	537289	393869167	27.0740	9.0164	2.86510	1.36304	2302.8	402273
734	538756	395492794	27.0924	9.0205	2.86570	1.36107	2305.9	402521
735	540225	397122725	27.1109	9.0246	2.86629	1.35910	2309.1	402769
736	541696	398758966	27.1293	9.0287	2.86688	1.35713	2312.2	403018
737	543169	400401523	27.1477	9.0328	2.86747	1.35516	2315.4	403268
738	544644	401950404	27.1662	9.0369	2.86806	1.35319	2318.5	403519
739	546121	403505619	27.1846	9.0410	2.86864	1.35122	2321.6	403771
740	547600	405067160	27.2029	9.0450	2.86923	1.34925	2324.8	404024
741	549081	406635031	27.2213	9.0491	2.86982	1.34728	2327.9	404278
742	550564	408209236	27.2397	9.0532	2.87040	1.34531	2331.1	404533
743	552049	409789779	27.2580	9.0572	2.87099	1.34334	2334.2	404789
744	553536	411376664	27.2764	9.0613	2.87157	1.34137	2337.3	405046
745	555025	412969895	27.2947	9.0654	2.87216	1.33940	2340.5	405304
746	556516	414569476	27.3130	9.0694	2.87274	1.33743	2343.6	405563
747	558009	416175403	27.3313	9.0735	2.87332	1.33546	2346.8	405823
748	559504	417787780	27.3496	9.0775	2.87390	1.33349	2349.9	406084
749	561001	419406611	27.3679	9.0816	2.87448	1.33152	2353.1	406346

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

FUNCTIONS OF NUMBERS

750

799

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
750	562500	421875000	27.3861	9.0856	2.87506	1.33333	2356.2	441786
751	564001	423564751	27.4044	9.0866	2.87564	1.33156	2359.3	442965
752	565504	425259008	27.4226	9.0877	2.87622	1.32979	2362.5	444146
753	567009	426957777	27.4408	9.0887	2.87680	1.32802	2365.6	445328
754	568516	428661064	27.4591	9.1017	2.87737	1.32626	2368.8	446511
755	570025	430368875	27.4773	9.1057	2.87795	1.32450	2371.9	447697
756	571536	432081216	27.4955	9.1068	2.87852	1.32275	2375.0	448883
757	573049	433798093	27.5136	9.1138	2.87910	1.32100	2378.2	450072
758	574564	435519512	27.5318	9.1178	2.87967	1.31925	2381.3	451262
759	576081	437245479	27.5500	9.1218	2.88024	1.31752	2384.5	452453
760	577600	438976000	27.5681	9.1258	2.88081	1.31579	2387.6	453646
761	579121	440711081	27.5862	9.1298	2.88138	1.31405	2390.8	454841
762	580644	442450728	27.6043	9.1338	2.88196	1.31234	2393.9	456037
763	582169	444194947	27.6225	9.1378	2.88252	1.31062	2397.0	457234
764	583696	445943744	27.6405	9.1418	2.88309	1.30890	2400.2	458434
765	585225	447697125	27.6586	9.1458	2.88366	1.30719	2403.3	459635
766	586756	449455096	27.6767	9.1498	2.88423	1.30548	2406.5	460837
767	588289	451217663	27.6948	9.1537	2.88480	1.30378	2409.6	462041
768	589824	452984832	27.7128	9.1577	2.88536	1.30208	2412.7	463247
769	591361	454756609	27.7308	9.1617	2.88593	1.30039	2415.9	464454
770	592900	456533000	27.7489	9.1657	2.88649	1.29870	2419.0	465663
771	594441	458314011	27.7669	9.1696	2.88705	1.29702	2422.2	466873
772	595984	460099648	27.7849	9.1736	2.88762	1.29534	2425.3	468085
773	597529	461889917	27.8029	9.1775	2.88818	1.29366	2428.5	469298
774	599076	463684824	27.8209	9.1815	2.88874	1.29199	2431.6	470513
775	600625	465484375	27.8388	9.1855	2.88930	1.29032	2434.7	471730
776	602176	467288576	27.8568	9.1894	2.88986	1.28866	2437.9	472948
777	603729	469097433	27.8747	9.1933	2.89042	1.28700	2441.0	474168
778	605284	470910952	27.8927	9.1973	2.89098	1.28535	2444.2	475389
779	606841	472729139	27.9106	9.2012	2.89154	1.28370	2447.3	476612
780	608400	474552000	27.9285	9.2052	2.89209	1.28205	2450.4	477836
781	609961	476379541	27.9464	9.2091	2.89265	1.28041	2453.6	479062
782	611524	478211768	27.9643	9.2130	2.89321	1.27877	2456.7	480290
783	613089	480048687	27.9821	9.2170	2.89376	1.27714	2459.9	481519
784	614656	481890304	28.0000	9.2209	2.89432	1.27551	2463.0	482750
785	616225	483736625	28.0179	9.2248	2.89487	1.27389	2466.2	483982
786	617796	485587656	28.0357	9.2287	2.89542	1.27226	2469.3	485216
787	619369	487443403	28.0535	9.2326	2.89597	1.27065	2472.4	486451
788	620944	489303872	28.0713	9.2365	2.89653	1.26904	2475.6	487688
789	622521	491169069	28.0891	9.2404	2.89708	1.26743	2478.7	488927
790	624100	493039000	28.1069	9.2443	2.89763	1.26582	2481.9	490167
791	625681	494913671	28.1247	9.2482	2.89818	1.26422	2485.0	491409
792	627264	496793088	28.1425	9.2521	2.89873	1.26263	2488.1	492652
793	628849	498677257	28.1603	9.2560	2.89927	1.26103	2491.3	493897
794	630436	500566184	28.1780	9.2599	2.89982	1.25945	2494.4	495143
795	632025	502459875	28.1957	9.2638	2.90037	1.25786	2497.6	496391
796	633616	504358336	28.2135	9.2677	2.90091	1.25628	2500.7	497641
797	635209	506261573	28.2312	9.2716	2.90145	1.25471	2503.8	498892
798	636804	508169592	28.2489	9.2754	2.90200	1.25313	2507.0	500145
799	638401	510082399	28.2666	9.2793	2.90255	1.25156	2510.1	501399

800

849

FUNCTIONS OF NUMBERS

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
800	640000	512000000	28.2843	9.2832	2.90309	1.25000	2513.3	502655
801	641601	513922401	28.3019	9.2870	2.90383	1.24844	2516.4	503912
802	643204	515849608	28.3196	9.2909	2.90417	1.24688	2519.6	505171
803	644809	517781627	28.3373	9.2948	2.90472	1.24533	2522.7	506432
804	646416	519718464	28.3549	9.2986	2.90526	1.24378	2525.8	507694
805	648025	521660125	28.3725	9.3025	2.90580	1.24224	2529.0	508956
806	649636	523606616	28.3901	9.3063	2.90634	1.24069	2532.1	510223
807	651249	525557943	28.4077	9.3102	2.90687	1.23916	2535.3	511490
808	652864	527514112	28.4253	9.3140	2.90741	1.23762	2538.4	512758
809	654481	529475129	28.4429	9.3179	2.90795	1.23609	2541.5	514028
810	656100	531441000	28.4605	9.3217	2.90849	1.23457	2544.7	515300
811	657721	533411731	28.4781	9.3255	2.90902	1.23305	2547.8	516573
812	659344	535387328	28.4956	9.3294	2.90956	1.23153	2551.0	517848
813	660969	537367797	28.5132	9.3332	2.91009	1.23001	2554.1	519124
814	662596	539353144	28.5307	9.3370	2.91062	1.22850	2557.3	520402
815	664225	541343375	28.5482	9.3408	2.91116	1.22699	2560.4	521681
816	665856	543338496	28.5657	9.3447	2.91169	1.22548	2563.5	522962
817	667489	545338513	28.5832	9.3485	2.91222	1.22397	2566.7	524245
818	669124	547343432	28.6007	9.3523	2.91275	1.22246	2569.8	525529
819	670761	549353259	28.6182	9.3561	2.91328	1.22100	2573.0	526814
820	672400	551368000	28.6356	9.3599	2.91381	1.21951	2576.1	528102
821	674041	553387661	28.6531	9.3637	2.91434	1.21803	2579.2	529391
822	675684	555412248	28.6705	9.3675	2.91487	1.21655	2582.4	530681
823	677329	557441767	28.6880	9.3713	2.91540	1.21507	2585.5	531973
824	678976	559476224	28.7054	9.3751	2.91593	1.21359	2588.7	533267
825	680625	561515625	28.7228	9.3789	2.91645	1.21212	2591.8	534562
826	682276	563559976	28.7402	9.3827	2.91698	1.21065	2595.0	535858
827	683929	565609283	28.7576	9.3865	2.91751	1.20919	2598.1	537157
828	685584	567663552	28.7750	9.3902	2.91803	1.20773	2601.2	538456
829	687241	569722789	28.7924	9.3940	2.91856	1.20627	2604.4	539758
830	688900	571787000	28.8097	9.3978	2.91908	1.20482	2607.5	541061
831	690561	573856191	28.8271	9.4016	2.91960	1.20337	2610.7	542365
832	692224	575930368	28.8444	9.4053	2.92012	1.20192	2613.8	543671
833	693889	578009537	28.8617	9.4091	2.92065	1.20048	2616.9	544979
834	695556	580093704	28.8791	9.4129	2.92117	1.19904	2620.1	546288
835	697225	582182875	28.8964	9.4166	2.92169	1.19760	2623.2	547599
836	698896	584277056	28.9137	9.4204	2.92221	1.19617	2626.4	548912
837	700569	586376253	28.9310	9.4241	2.92273	1.19474	2629.5	550226
838	702244	588480472	28.9482	9.4279	2.92324	1.19332	2632.7	551541
839	703921	590589719	28.9655	9.4316	2.92376	1.19190	2635.8	552858
840	705600	592704000	28.9828	9.4354	2.92428	1.19048	2638.9	554177
841	707281	594823321	29.0000	9.4391	2.92480	1.18906	2642.1	555497
842	708964	596947688	29.0172	9.4429	2.92531	1.18765	2645.2	556819
843	710649	599077107	29.0345	9.4466	2.92583	1.18624	2648.4	558142
844	712336	601211584	29.0517	9.4503	2.92634	1.18483	2651.5	559467
845	714025	603351125	29.0689	9.4541	2.92686	1.18343	2654.6	560794
846	715716	605495736	29.0861	9.4578	2.92737	1.18203	2657.8	562122
847	717409	607645423	29.1033	9.4615	2.92788	1.18064	2660.9	563452
848	719104	609800192	29.1204	9.4652	2.92839	1.17925	2664.1	564783
849	720801	611960049	29.1376	9.4690	2.92891	1.17786	2667.2	566116

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

FUNCTIONS OF NUMBERS

850

899

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. x Diameter	
							Circum.	Area
850	722500	614125000	29.1548	9.4727	2.92942	1.17647	2670.4	567450
851	724201	616295051	29.1719	9.4764	2.92993	1.17659	2673.5	568798
852	725904	618470208	29.1890	9.4801	2.93044	1.17371	2676.6	570124
853	727609	620650477	29.2062	9.4838	2.93095	1.17233	2679.8	571463
854	729315	622835864	29.2233	9.4875	2.93146	1.17096	2682.9	572803
855	731025	625026375	29.2404	9.4912	2.93197	1.16959	2686.1	574146
856	732736	627222016	29.2575	9.4949	2.93247	1.16822	2689.2	575490
857	734449	629422793	29.2746	9.4986	2.93298	1.16686	2692.3	576835
858	736164	631628712	29.2916	9.5023	2.93349	1.16550	2695.5	578182
859	737881	633839779	29.3087	9.5060	2.93399	1.16414	2698.6	579530
860	739600	636056000	29.3258	9.5097	2.93450	1.16279	2701.8	580880
861	741321	638277381	29.3428	9.5134	2.93500	1.16144	2704.9	582232
862	743044	640503928	29.3598	9.5171	2.93551	1.16009	2708.1	583585
863	744769	642735647	29.3769	9.5207	2.93601	1.15875	2711.2	584940
864	746496	644972544	29.3939	9.5244	2.93651	1.15741	2714.3	586297
865	748225	647214625	29.4109	9.5281	2.93702	1.15607	2717.5	587655
866	749956	649461896	29.4279	9.5317	2.93752	1.15473	2720.6	589014
867	751689	651714363	29.4449	9.5354	2.93802	1.15340	2723.8	590375
868	753424	653972032	29.4618	9.5391	2.93852	1.15207	2726.9	591738
869	755161	656234909	29.4788	9.5427	2.93902	1.15075	2730.0	593102
870	756900	658503000	29.4958	9.5464	2.93952	1.14943	2733.2	594468
871	758641	660776311	29.5127	9.5501	2.94002	1.14811	2736.3	595835
872	760384	663054848	29.5296	9.5537	2.94052	1.14679	2739.5	597204
873	762129	665338617	29.5465	9.5574	2.94101	1.14548	2742.6	598575
874	763876	667627624	29.5635	9.5610	2.94151	1.14416	2745.8	599947
875	765625	669921875	29.5804	9.5647	2.94201	1.14286	2748.9	601320
876	767376	672222376	29.5973	9.5683	2.94250	1.14155	2752.0	602696
877	769129	674528133	29.6142	9.5719	2.94300	1.14025	2755.2	604073
878	770884	676839152	29.6311	9.5756	2.94349	1.13895	2758.3	605451
879	772641	679151439	29.6479	9.5792	2.94399	1.13766	2761.5	606831
880	774400	681472000	29.6648	9.5828	2.94448	1.13636	2764.6	608212
881	776161	683797941	29.6816	9.5865	2.94498	1.13507	2767.7	609595
882	777924	686128968	29.6985	9.5901	2.94548	1.13379	2770.9	610980
883	779689	688465387	29.7153	9.5937	2.94598	1.13250	2774.0	612366
884	781456	690807104	29.7321	9.5973	2.94648	1.13122	2777.2	613754
885	783225	693154125	29.7489	9.6010	2.94699	1.12994	2780.3	615143
886	784996	695506456	29.7658	9.6046	2.94749	1.12867	2783.5	616534
887	786769	697864103	29.7825	9.6082	2.94799	1.12740	2786.6	617927
888	788544	700227072	29.7993	9.6118	2.94849	1.12613	2789.7	619321
889	790321	702595369	29.8161	9.6154	2.94899	1.12486	2792.9	620717
890	792100	704969000	29.8329	9.6190	2.94949	1.12360	2796.0	622114
891	793881	707347971	29.8496	9.6226	2.94998	1.12233	2799.2	623513
892	795664	709732288	29.8664	9.6262	2.95048	1.12106	2802.3	624913
893	797449	712121957	29.8831	9.6298	2.95098	1.11982	2805.4	626315
894	799236	714516984	29.8998	9.6334	2.95148	1.11857	2808.6	627718
895	801025	716917375	29.9166	9.6370	2.95198	1.11732	2811.7	629124
896	802816	719323136	29.9333	9.6406	2.95248	1.11607	2814.9	630530
897	804609	721734273	29.9500	9.6442	2.95297	1.11483	2818.0	631938
898	806404	724150792	29.9666	9.6477	2.95348	1.11359	2821.2	633348
899	808201	726572699	29.9833	9.6513	2.95397	1.11235	2824.3	634760

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

FUNCTIONS OF NUMBERS

No.	Squares	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
900	810000	729000000	30.0000	9.6549	2.95424	1.11111	2827.4	636173
901	811801	731432701	30.0167	9.6585	2.95472	1.10988	2830.6	637587
902	813604	733870808	30.0333	9.6620	2.95521	1.10865	2833.7	639000
903	815409	736314327	30.0500	9.6656	2.95569	1.10742	2836.9	640421
904	817216	738763264	30.0666	9.6692	2.95617	1.10619	2840.0	641840
905	819025	741217625	30.0832	9.6727	2.95665	1.10497	2843.1	643261
906	820836	743677416	30.0998	9.6763	2.95713	1.10375	2846.3	644683
907	822649	746142643	30.1164	9.6799	2.95761	1.10254	2849.4	646107
908	824464	748613312	30.1330	9.6834	2.95809	1.10132	2852.6	647533
909	826281	751089429	30.1496	9.6870	2.95856	1.10011	2855.7	648960
910	828100	753571000	30.1662	9.6905	2.95904	1.09890	2858.8	650388
911	829921	756058031	30.1828	9.6941	2.95952	1.09769	2862.0	651818
912	831744	758550528	30.1993	9.6976	2.95999	1.09649	2865.1	653250
913	833569	761048497	30.2159	9.7012	2.96047	1.09529	2868.3	654684
914	835396	763551944	30.2324	9.7047	2.96095	1.09409	2871.4	656118
915	837225	766060875	30.2490	9.7082	2.96142	1.09290	2874.6	657555
916	839056	768575296	30.2655	9.7118	2.96190	1.09170	2877.7	658993
917	840889	771095213	30.2820	9.7153	2.96237	1.09051	2880.8	660433
918	842724	773620632	30.2985	9.7188	2.96284	1.08932	2884.0	661874
919	844561	776151559	30.3150	9.7224	2.96332	1.08814	2887.1	663317
920	846400	778688000	30.3315	9.7259	2.96379	1.08696	2890.3	664761
921	848241	781229961	30.3480	9.7294	2.96426	1.08578	2893.4	666207
922	850084	783777448	30.3645	9.7329	2.96473	1.08460	2896.5	667654
923	851929	786330467	30.3809	9.7364	2.96520	1.08342	2899.7	669103
924	853776	788889024	30.3974	9.7400	2.96567	1.08225	2902.8	670554
925	855625	791453125	30.4138	9.7435	2.96614	1.08108	2906.0	672006
926	857476	794022776	30.4302	9.7470	2.96661	1.07991	2909.1	673460
927	859329	796597983	30.4467	9.7505	2.96708	1.07875	2912.3	674915
928	861184	799178752	30.4631	9.7540	2.96755	1.07759	2915.4	676372
929	863041	801765089	30.4795	9.7575	2.96802	1.07643	2918.5	677831
930	864900	804357000	30.4959	9.7610	2.96848	1.07527	2921.7	679291
931	866761	806954491	30.5123	9.7645	2.96895	1.07411	2924.8	680752
932	868624	809557568	30.5287	9.7680	2.96942	1.07296	2928.0	682216
933	870489	812166237	30.5450	9.7715	2.96989	1.07181	2931.1	683680
934	872356	814780504	30.5614	9.7750	2.97035	1.07066	2934.2	685147
935	874225	817400375	30.5778	9.7785	2.97081	1.06952	2937.4	686615
936	876096	820025856	30.5941	9.7819	2.97128	1.06838	2940.5	688084
937	877969	822656953	30.6105	9.7854	2.97174	1.06724	2943.7	689555
938	879844	825293672	30.6268	9.7889	2.97220	1.06610	2946.8	691028
939	881721	827936019	30.6431	9.7924	2.97267	1.06496	2950.0	692502
940	883600	830584000	30.6594	9.7959	2.97313	1.06383	2953.1	693978
941	885481	833237621	30.6757	9.7993	2.97359	1.06270	2956.2	695455
942	887364	835896888	30.6920	9.8028	2.97405	1.06157	2959.4	696934
943	889249	838561807	30.7083	9.8063	2.97451	1.06045	2962.5	698415
944	891136	841232384	30.7246	9.8097	2.97497	1.05932	2965.7	699897
945	893025	843908625	30.7409	9.8132	2.97543	1.05820	2968.8	701380
946	894916	846590536	30.7571	9.8167	2.97589	1.05708	2971.9	702865
947	896809	849278123	30.7734	9.8201	2.97635	1.05597	2975.1	704352
948	898704	851971392	30.7896	9.8236	2.97681	1.05485	2978.2	705840
949	900601	854670349	30.8058	9.8270	2.97727	1.05374	2981.4	707330

FUNCTIONS OF NUMBERS

950

999

No.	Square	Cube	Square Root	Cube Root	Logarithm	1000 X Reciprocal	No. = Diameter	
							Circum.	Area
950	902500	857375000	30.8221	9.8305	2.97772	1.05263	2984.5	708822
951	904401	860085351	30.8383	9.8339	2.97818	1.05152	2987.7	710315
952	906304	862801408	30.8545	9.8374	2.97864	1.05042	2990.8	711809
953	908209	865523177	30.8707	9.8408	2.97909	1.04932	2993.9	713306
954	910116	868250654	30.8869	9.8443	2.97955	1.04822	2997.1	714803
955	912025	870963875	30.9031	9.8477	2.98000	1.04712	3000.2	716303
956	913936	873722816	30.9192	9.8511	2.98046	1.04603	3003.4	717804
957	915849	876487493	30.9354	9.8546	2.98091	1.04493	3006.5	719308
958	917764	879251792	30.9516	9.8580	2.98137	1.04384	3009.6	720810
959	919681	881974079	30.9677	9.8614	2.98182	1.04275	3012.8	722316
960	921600	884736000	30.9839	9.8648	2.98227	1.04167	3015.9	723823
961	923521	887503681	31.0000	9.8683	2.98272	1.04058	3019.1	725332
962	925444	890277128	31.0161	9.8717	2.98318	1.03950	3022.2	726842
963	927369	893056347	31.0322	9.8751	2.98363	1.03842	3025.4	728354
964	929296	895841344	31.0483	9.8785	2.98408	1.03734	3028.5	729867
965	931225	898632125	31.0644	9.8819	2.98453	1.03627	3031.6	731382
966	933156	901428696	31.0805	9.8854	2.98498	1.03520	3034.8	732899
967	935089	904231063	31.0966	9.8888	2.98543	1.03413	3037.9	734417
968	937024	907039232	31.1127	9.8922	2.98588	1.03306	3041.1	735937
969	938961	909853209	31.1288	9.8956	2.98632	1.03199	3044.2	737458
970	940900	912673000	31.1448	9.8990	2.98677	1.03093	3047.3	738981
971	942841	915498611	31.1609	9.9024	2.98722	1.02987	3050.5	740506
972	944784	918330048	31.1769	9.9058	2.98767	1.02881	3053.6	742032
973	946729	921167317	31.1929	9.9092	2.98811	1.02775	3056.8	743559
974	948676	924010424	31.2090	9.9126	2.98856	1.02669	3059.9	745088
975	950625	926859375	31.2250	9.9160	2.98900	1.02564	3063.1	746619
976	952576	929714176	31.2410	9.9194	2.98945	1.02459	3066.2	748151
977	954529	932574833	31.2570	9.9227	2.98989	1.02354	3069.3	749685
978	956484	935441352	31.2730	9.9261	2.99034	1.02249	3072.5	751221
979	958441	938313739	31.2890	9.9295	2.99078	1.02145	3075.6	752758
980	960400	941192000	31.3050	9.9329	2.99123	1.02041	3078.8	754296
981	962361	944076141	31.3209	9.9363	2.99167	1.01937	3081.9	755837
982	964324	946966168	31.3369	9.9396	2.99211	1.01833	3085.0	757378
983	966289	949862087	31.3528	9.9430	2.99255	1.01729	3088.2	758922
984	968256	952763904	31.3688	9.9464	2.99300	1.01626	3091.3	760466
985	970225	955671625	31.3847	9.9497	2.99344	1.01523	3094.5	762013
986	972196	958585256	31.4006	9.9531	2.99388	1.01420	3097.6	763561
987	974169	961504803	31.4166	9.9565	2.99432	1.01317	3100.8	765111
988	976144	964430272	31.4325	9.9598	2.99476	1.01215	3103.9	766662
989	978121	967361669	31.4484	9.9632	2.99520	1.01112	3107.0	768214
990	980100	970299000	31.4643	9.9666	2.99564	1.01010	3110.2	769769
991	982081	973242271	31.4802	9.9699	2.99607	1.00908	3113.3	771325
992	984064	976191488	31.4960	9.9733	2.99651	1.00806	3116.5	772882
993	986049	979146657	31.5119	9.9766	2.99695	1.00705	3119.6	774441
994	988036	982107784	31.5278	9.9800	2.99739	1.00604	3122.7	776002
995	990025	985074875	31.5436	9.9833	2.99782	1.00503	3125.9	777564
996	992016	988047936	31.5595	9.9866	2.99826	1.00402	3129.0	779128
997	994009	991026973	31.5753	9.9900	2.99870	1.00301	3132.2	780693
998	996004	994011992	31.5911	9.9933	2.99913	1.00200	3135.3	782260
999	998001	997002999	31.6070	9.9967	2.99957	1.00100	3138.5	783828

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

1.10 ARITHMETICAL SHORTCUTS

The number multiplied is the multiplicand; the number multiplied by is the multiplier; the answer is the product.

Converting Feet to Inches

To multiply feet by	Operation	Examples
1 in.	Divide by 12	$192' \times 1'' = \frac{192}{12} = 16 \text{ sq ft}$
$1\frac{1}{2}$ in.	Divide by 8	$214' \times 1\frac{1}{2}'' = \frac{214}{\frac{8}{3}} = 26.75 \text{ sq ft}$
2 in.	Divide by 6	$92' 7'' \times 2'' = \frac{92.12}{\frac{6}{3}} = 15.43 \text{ sq ft}$
3 in.	Divide by 4	$217' 4'' \times 3'' = \frac{217.32}{\frac{4}{3}} = 54.33 \text{ sq ft}$
4 in.	Divide by 3	$722' 6'' \times 4'' = \frac{722.1}{\frac{3}{2}} = 240.63 \text{ sq ft}$
$4\frac{1}{2}$ in.	Multiply by $\frac{2}{3}$	$412' 8'' \times 4\frac{1}{2}'' = \frac{412.67 \times 3}{8} = 154.75 \text{ sq ft}$
5 in.	Multiply by $\frac{1}{3}$	$322' 2'' \times 5'' = \frac{322.17 \times 5}{12} = 134.24 \text{ sq ft}$
6 in.	Divide by 2	$190' 10'' \times 6'' = \frac{190.83}{\frac{2}{3}} = 95.42 \text{ sq ft}$
7 in.	Multiply by $\frac{1}{12}$	$522' 9'' \times 7'' = \frac{522.75 \times 7}{12} = 304.94 \text{ sq ft}$
$7\frac{1}{2}$ in.	Multiply by $\frac{2}{3}$	$132' \times 7\frac{1}{2}'' = \frac{132 \times 5}{8} = 82.5 \text{ sq ft}$
8 in.	Deduct $\frac{1}{3}$	$\begin{array}{r} 272' 6'' \times 8'' = 272.50 \\ (-\frac{1}{3}) \quad \quad \quad -90.83 \\ \hline 181.67 \text{ sq ft} \end{array}$
9 in.	Deduct $\frac{1}{4}$	$\begin{array}{r} 922' 4'' \times 9'' = 922.33 \\ (-\frac{1}{4}) \quad \quad \quad -230.58 \\ \hline 691.75 \text{ sq ft} \end{array}$
10 in.	Deduct $\frac{1}{5}$	$\begin{array}{r} 483' \times 10'' = 483.00 \\ (-\frac{1}{5}) \quad \quad \quad -80.50 \\ \hline 402.50 \text{ sq ft} \end{array}$
$10\frac{1}{2}$ in.	Deduct $\frac{1}{4}$	$\begin{array}{r} 773' 6'' \times 10\frac{1}{2}'' = 773.5 \\ (-\frac{1}{4}) \quad \quad \quad -96.7 \\ \hline 676.8 \text{ sq ft} \end{array}$
11 in.	Deduct $\frac{1}{11}$	$\begin{array}{r} 649' 3'' \times 11'' = 649.25 \\ (-\frac{1}{11}) \quad \quad \quad -54.10 \\ \hline 595.15 \text{ sq ft} \end{array}$

1.10 ARITHMETICAL SHORTCUTS (Cont.)

The number multiplied is the multiplicand; the number multiplied by is the multiplier; the answer is the product.

Multiplication

To multiply by	Operation	Examples
9	Add a zero and subtract the multiplicand	$132 \times 9 = \begin{array}{r} 1,320 \\ -132 \\ \hline 1,188 \end{array}$
11	Place the sum of the digits between the two outside digits, adding 1 to the left-hand digit if the sum exceeds 9	$42 \times 11 = 4*2 \quad (4 + 2 = 6) = 462$ $94 \times 11 = 9*4 \quad (9 + 4 = 13; \text{ therefore, } 9 \text{ is increased to } 10) = 1,034$ $253 \times 11 = \begin{array}{r} 2,**3 \quad (5 + 3 = 8) \\ 2,*83 \quad (5 + 2 = 7) \\ \hline 2,783 \end{array}$ $392 \times 11 = \begin{array}{r} 3,**2 \quad (9 + 2 = 11) \\ 3,112 \quad (9 + 3 = 12) \\ \hline 4,312 \end{array}$
15	Add a zero; then add half of that figure	$732 \times 15 = \begin{array}{r} 7,320 \\ +3,660 \\ \hline 10,980 \end{array}$
18	Double the multiplier, add zero, and subtract the doubled multiplier	$1,216 \times 18 = \begin{array}{r} 24,320 \\ -2,432 \\ \hline 21,888 \end{array}$
19	Double the multiplier, add zero, and subtract the multiplier	$1,733 \times 19 = \begin{array}{r} 34,660 \\ -1,773 \\ \hline 32,927 \end{array}$
21	Multiply by 2, add a zero, and add the multiplier	$713 \times 21 = \begin{array}{r} 14,260 \\ +713 \\ \hline 14,973 \end{array}$
22	Multiply by 2, add a zero, and add the figure without the zero	$827 \times 22 = \begin{array}{r} 16,540 \\ +1,654 \\ \hline 18,194 \end{array}$

1.10 ARITHMETICAL SHORTCUTS (Cont.)

The number multiplied is the multiplicand; the number multiplied by is the multiplier; the answer is the product.

Multiplication (Cont.)

To multiply by	Operation	Examples
25	Add two zeros and divide by 4	$216 \times 25 = \frac{21,600}{4} = 5,400$
27	Multiply by 3, add a zero, and subtract the figure without the zero	$439 \times 27 = \begin{array}{r} 13,170 \quad (439 \times 3 = \\ -1,317 \quad 1,317, + 0) \\ \hline 11,853 \end{array}$
28	Multiply by 3, add a zero, and subtract twice the multiplicand	$628 \times 28 = \begin{array}{r} 18,840 \\ - (2 \times 628) \quad -1,256 \\ \hline 17,584 \end{array}$
29	Multiply by 3, add a zero, and subtract the multiplicand	$526 \times 29 = \begin{array}{r} 15,780 \\ - 526 \\ \hline 15,254 \end{array}$
31	Multiply by 3, add a zero, and add the multiplicand	$428 \times 31 = \begin{array}{r} 12,840 \\ + 428 \\ \hline 13,268 \end{array}$
33	Multiply by 3, add a zero, and add the figure without the zero	$289 \times 33 = \begin{array}{r} 8,670 \\ + 867 \\ \hline 9,537 \end{array}$
36	Multiply by 4, add a zero, and subtract the figure without the zero	$273 \times 36 = \begin{array}{r} 10,920 \\ - 1,092 \\ \hline 9,828 \end{array}$
39	Multiply by 4, add a zero, and subtract the multiplicand	$365 \times 39 = \begin{array}{r} 14,600 \\ - 365 \\ \hline 14,235 \end{array}$
41	Multiply by 4, add a zero, and add the multiplicand	$538 \times 41 = \begin{array}{r} 21,520 \\ + 538 \\ \hline 22,058 \end{array}$
49, 59, 69, 79, 89, or 99	Go up one (that is, multiply by 5, 6, etc., and add a zero) and subtract the multiplicand	$571 \times 49 = \begin{array}{r} 28,550 \quad (571 \times 5, \\ - 571 \quad + 0) \\ \hline 27,979 \end{array}$ $571 \times 79 = \begin{array}{r} 45,680 \quad (571 \times 8, \\ - 571 \quad + 0) \\ \hline 45,109 \end{array}$

1.10 ARITHMETICAL SHORTCUTS (Cont.)

The number multiplied is the multiplicand; the number multiplied by is the multiplier; the answer is the product.

Multiplication (Cont.)

To multiply by	Operation	Examples
51, 61, 71, 81, or 91	Multiply by first digit (5, 6, etc.), add a zero, and add the multiplicand	$\begin{array}{r} 571 \times 51 = 28,550 \\ + 571 \\ \hline 29,121 \end{array}$ $\begin{array}{r} 571 \times 91 = 51,390 \\ + 571 \\ \hline 51,961 \end{array}$
44, 55, 66, 77, or 88	Multiply by the first digit, add a zero, and add the figure without the zero	$\begin{array}{r} 736 \times 44 = 29,440 \quad (736 \times 4, \\ + 2,944 \quad + 0) \\ \hline 32,384 \end{array}$ $\begin{array}{r} 736 \times 88 = 58,880 \\ + 5,880 \\ \hline 64,760 \end{array}$
45, 54, 63, 72, or 81	Multiply by one more than the first digit (5, 6, 7, etc.), add zero, and subtract the figure without the zero	$\begin{array}{r} 582 \times 45 = 29,100 \quad (582 \times 5, \\ - 2,910 \quad + 0) \\ \hline 26,190 \end{array}$ $\begin{array}{r} 582 \times 72 = 46,560 \quad (582 \times 8, \\ - 4,656 \quad + 0) \\ \hline 41,904 \end{array}$

1.11 MULTIPLICATION AND DIVISION

To multiply: Read the product at the intersection of the two numbers, one on the top line and one on the side column. For example, 12 multiplied by 17 equals 204.

To divide: From the side column, move horizontally along the line of the number to divide by until you come to the number to be divided, then move vertically to find the answer on the top line. For example, 437 divided by 19 equals 23.

The squares of the root numbers are in slightly heavier type on the diagonal from the upper left-hand corner.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	1	
2		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	2
3		3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75	3
4		4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	4
5		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	5
6		6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132	138	144	150	6
7		7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147	154	161	168	175	7
8		8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200	8
9		9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180	189	198	207	216	225	9
10		10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	10
11		11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220	231	242	253	264	275	11
12		12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240	252	264	276	288	300	12
13		13	26	39	52	65	78	91	104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	13
14		14	28	42	56	70	84	98	112	126	140	154	168	182	196	210	224	238	252	266	280	294	308	322	336	350	14
15		15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	375	15
16		16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320	336	352	368	384	400	16
17		17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340	357	374	391	408	425	17
18		18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396	414	432	450	18
19		19	38	57	76	95	114	133	152	171	190	209	228	247	266	285	304	323	342	361	380	399	418	437	456	475	19
20		20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	20
21		21	42	63	84	105	126	147	168	189	210	231	252	273	294	315	336	357	378	399	420	441	462	483	504	525	21
22		22	44	66	88	110	132	154	176	198	220	242	264	286	308	330	352	374	396	418	440	462	484	506	528	550	22
23		23	46	69	92	115	138	161	184	207	230	253	276	299	322	345	368	391	414	437	460	483	506	529	552	575	23
24		24	48	72	96	120	144	168	192	216	240	264	288	312	336	360	384	408	432	456	480	504	528	552	576	600	24
25		25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	25

1.12 LENGTH OF CIRCULAR ARCS FOR UNIT RADIUS

By the use of this table, the length of any arc may be found if the length of the radius and the angle of the segment are known.

Example:—Required the length of arc of segment $32^{\circ} 15' 27''$ with radius of 24 feet 3 inches.

From table: Length of arc (Radius 1) for $32^{\circ} = .585054$
 $15' = .0043633$
 $27'' = .0001309$
.5629996

$$.5629996 \times 24.25 \text{ (length of radius)} = 13.65 \text{ feet}$$

DEGREES			MINUTES			SECONDS		
1	20	39	1	2	3	1	2	3
.017 4533	.349 0659	.680 6784	.000 2909	.000 5818	.000 8727	.000 0048	.000 0097	.000 0145
.034 9066	.366 5191	.698 1317	.000 5818	.000 8727	.001 1636	.000 0145	.000 0194	.000 0242
.052 3599	.383 9724	.715 5850	.001 1636	.001 4544	.001 7453	.000 0291	.000 0339	.000 0388
.069 8132	.401 4257	.733 0383	.001 4544	.001 7453	.002 0362	.000 0388	.000 0436	.000 0485
.087 2665	.418 8790	.750 4916	.002 0362	.002 3271	.002 6180	.000 0485	.000 0533	.000 0582
.104 7198	.436 3323	.767 9449	.002 3271	.002 6180	.002 9089	.000 0533	.000 0582	.000 0630
.122 1730	.453 7856	.785 3982	.002 6180	.002 9089	.003 1998	.000 0630	.000 0679	.000 0727
.139 6263	.471 2389	.802 8515	.003 1998	.003 4907	.003 7815	.000 0727	.000 0776	.000 0824
.157 0796	.488 6922	.820 3047	.003 4907	.003 7815	.004 0724	.000 0824	.000 0873	.000 0921
.174 5329	.506 1455	.837 7580	.004 0724	.004 3633	.004 6542	.000 0921	.000 0970	.000 1018
.191 9862	.523 5988	.855 2113	.004 3633	.004 6542	.004 9451	.000 1018	.000 1067	.000 1115
.209 4395	.541 0521	.872 6646	.004 6542	.004 9451	.005 2360	.000 1115	.000 1164	.000 1212
.226 8928	.558 5054	.890 1179	.004 9451	.005 2360	.005 5269	.000 1212	.000 1261	.000 1309
.244 3461	.575 9587	.907 5712	.005 2360	.005 5269	.005 8178	.000 1309	.000 1358	.000 1406
.261 7994	.593 4119	.925 0245	.005 5269	.005 8178	.006 1087	.000 1406	.000 1455	.000 1503
.279 2527	.610 8652	.942 4778	.006 1087	.006 4087	.006 6996	.000 1503	.000 1552	.000 1600
.296 7060	.628 3185	.959 9311	.006 4087	.006 6996	.006 9905	.000 1600	.000 1649	.000 1697
.314 1593	.645 7718	.977 3844	.006 6996	.006 9905	.007 2814	.000 1697	.000 1746	.000 1794
.331 6126	.663 2251	.994 8377	.006 9905	.007 2814	.007 5723	.000 1794	.000 1843	.000 1891

58	1,012 2910	88	1,535 8897	118	2,059 4885	20	.005 8178	20	.000 0970
59	1,029 7443	89	1,553 3430	119	2,076 9418	21	.006 1087	21	.000 1018
60	1,047 1976	90	1,570 7963	120	2,094 3951	22	.006 3935	22	.000 1067
61	1,064 6508	91	1,588 2496	121	2,111 8484	23	.006 6904	23	.000 1115
62	1,082 1041	92	1,605 7029	122	2,129 3017	24	.006 9813	24	.000 1164
63	1,099 5574	93	1,623 1562	123	2,146 7550	25	.007 2722	25	.000 1212
64	1,117 0107	94	1,640 6095	124	2,164 2083	26	.007 5631	26	.000 1261
65	1,134 4640	95	1,658 0628	125	2,181 6616	27	.007 8540	27	.000 1309
66	1,151 9173	96	1,675 5161	126	2,199 1149	28	.008 1449	28	.000 1357
67	1,169 3706	97	1,692 9694	127	2,216 5682	29	.008 4358	29	.000 1406
68	1,186 8239	98	1,710 4227	128	2,234 0214	30	.008 7256	30	.000 1454
69	1,204 2772	99	1,727 8760	129	2,251 4747	31	.009 0175	31	.000 1503
70	1,221 7305	100	1,745 3293	130	2,268 9280	32	.009 3084	32	.000 1551
71	1,239 1838	101	1,762 7825	131	2,286 3813	33	.009 5993	33	.000 1600
72	1,256 6371	102	1,780 2358	132	2,303 8346	34	.009 8902	34	.000 1648
73	1,274 0904	103	1,797 6891	133	2,321 2879	35	.010 1811	35	.000 1697
74	1,291 5436	104	1,815 1424	134	2,338 7412	36	.010 4720	36	.000 1745
75	1,308 9969	105	1,832 5957	135	2,356 1945	37	.010 7629	37	.000 1794
76	1,326 4502	106	1,850 0490	136	2,373 6478	38	.011 0538	38	.000 1842
77	1,343 9035	107	1,867 5023	137	2,391 1011	39	.011 3446	39	.000 1891
78	1,361 3568	108	1,884 9556	138	2,408 5544	40	.011 6355	40	.000 1939
79	1,378 8101	109	1,902 4089	139	2,426 0077	41	.011 9264	41	.000 1988
80	1,396 2634	110	1,919 8622	140	2,443 4610	42	.012 2173	42	.000 2036
81	1,413 7167	111	1,937 3155	141	2,460 9142	43	.012 5082	43	.000 2085
82	1,431 1700	112	1,954 7688	142	2,478 3675	44	.012 7991	44	.000 2133
83	1,448 6233	113	1,972 2221	143	2,495 8208	45	.013 0900	45	.000 2182
84	1,466 0766	114	1,989 6753	144	2,513 2741	46	.013 3809	46	.000 2230
85	1,483 5299	115	2,007 1286	145	2,530 7274	47	.013 6717	47	.000 2279
86	1,500 9832	116	2,024 5819	146	2,548 1807	48	.013 9626	48	.000 2327
87	1,518 4364	117	2,042 0352	147	2,565 6340	49	.014 2535	49	.000 2376

1.12 LENGTH OF CIRCULAR ARCS FOR UNIT RADIUS (Cont.)

DEGREES				MINUTES		SECONDS
148	2.583 0873	159	2.775 0735	170	2.967 0597	50 .000 2424
149	2.600 5406	160	2.792 5268	171	2.984 5130	51 .000 2473
150	2.617 9939	161	2.809 9801	172	3.001 9663	52 .000 2521
151	2.635 4472	162	2.827 4334	173	3.019 4196	53 .000 2570
152	2.652 9005	163	2.844 8867	174	3.036 8729	54 .000 2618
153	2.670 3538	164	2.862 3400	175	3.054 3262	55 .000 2666
154	2.687 8070	165	2.879 7933	176	3.071 7795	56 .000 2715
155	2.705 2603	166	2.897 2466	177	3.089 2328	57 .000 2763
156	2.722 7136	167	2.914 6999	178	3.106 6861	58 .000 2812
157	2.740 1669	168	2.932 1531	179	3.124 1394	59 .000 2860
158	2.757 6202	169	2.949 6064	180	3.141 5927	60 .000 2909

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

1.13 PROPERTIES OF THE CIRCLE

(American Institute of Steel Construction)

$$\begin{aligned}\text{Circumference} &= 6.28318 \, r = 3.14159 \, d \\ \text{Diameter} &= 0.31831 \, \text{circumference} \\ \text{Area} &= 3.14159 \, r^2\end{aligned}$$

$$\text{Arc } a = \frac{\pi r A^\circ}{180^\circ} = 0.017453 \, r A^\circ$$

$$\text{Angle } A^\circ = \frac{180^\circ a}{\pi r} = 57.29578 \frac{a}{r}$$

$$\text{Radius } r = \frac{4 \, b^2 + c^2}{8 \, b}$$

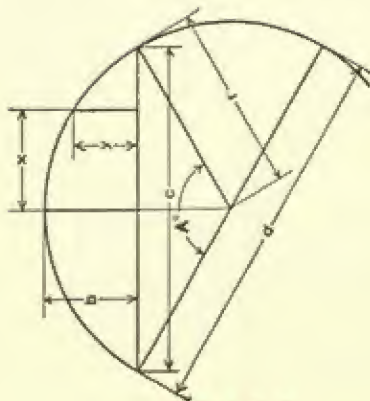
$$\text{Chord } c = 2 \sqrt{2 \, br - b^2} = 2 \, r \sin \frac{A}{2}$$

$$\begin{aligned}\text{Rise } b &= r - \frac{1}{2} \sqrt{4 \, r^2 - c^2} = \frac{c}{2} \tan \frac{A}{4} \\ &= 2 \, r \sin^2 \frac{A}{4} = r + y - \sqrt{r^2 - x^2}\end{aligned}$$

$$y = b - r + \sqrt{r^2 - x^2}$$

$$x = \sqrt{r^2 - (r + y - b)^2}$$

Diameter of circle of equal periphery as square = 1.27324 side of square
Side of square of equal periphery as circle = 0.78540 diameter of circle
Diameter of circle circumscribed about square = 1.41421 side of square
Side of square inscribed in circle = 0.70711 diameter of circle



40499

CIRCULAR SECTOR

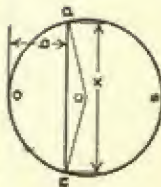


r = radius of circle y = angle ncp in degrees
 Area of Sector ncpo = $\frac{1}{2}x$ (length of arc ncp $\times r$)

$$= \text{Area of Circle} \times \frac{y}{360}$$

$$= 0.0087266 \times r^2 \times y$$

CIRCULAR SEGMENT



r = radius of circle x = chord b = rise

Area of Segment ncp = Area of Sector ncpo — Area of triangle ncp

$$= \frac{(\text{Length of arc ncp} \times r) - x(r - b)}{2}$$

Area of Segment nsp = Area of Circle — Area of Segment ncp

VALUES FOR FUNCTIONS OF π

$$\pi = 3.14159265359, \quad \log = 0.4971499$$

$$\pi^2 = 9.8696044, \log = 0.9942997 \quad \frac{1}{\pi} = 0.3183099, \log = \overline{1.5028501} \quad \sqrt{\frac{1}{\pi}} = 0.5641896, \log = \overline{1.7514251}$$

$$\pi^3 = 31.0062767, \log = 1.4914496 \quad \frac{1}{\pi^2} = 0.1013212, \log = \overline{1.0057003} \quad \frac{\pi}{180} = 0.0174533, \log = \overline{2.2418774}$$

$$\sqrt{\pi} = 1.7724539, \log = 0.2485749 \quad \frac{1}{\pi^3} = 0.0322515, \log = \overline{2.5085500} \quad \frac{180}{\pi} = 57.2957795, \log = 1.7581226$$

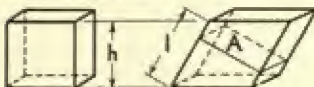
1.14 FINDING SURFACES AND VOLUMES OF SOLIDS

(S = lateral or convex surface; V = volume)

SHAPE

FORMULAS

Parallelepiped

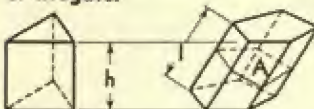


S = perimeter, P, perp. to sides
x lat. length l : Pl .

V = area of base, B, x perpendicular height, h : Bh .

V = area of section, A, perp. to sides, x lat. length l : Al .

Prism right, or oblique, regular or irregular

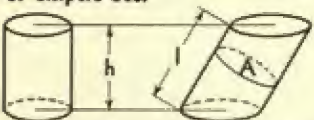


S = perimeter, P, perp. to sides
x lat. length l : Pl .

V = area of base, B, x perpendicular height, h : Bh .

V = area of section, A, perp. to sides, x lat. length l : Al .

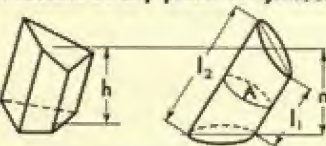
Cylinder, right or oblique, circular or elliptic etc.



S = perimeter of base, P, x perp. height, h : Ph . S_1 = perimeter, P_1 , perp. x lat. length, l : $P_1 l$.

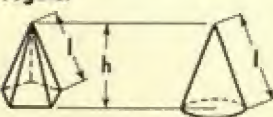
V = area of base, B, x perp. height, h : Bh . V = area of section, A, perp. to sides x lat. length l : Al .

Frustum of any prism or cylinder



V = area of base, B, x perpendicular distance h, from base to centre of gravity of opposite face : Bh .
for cylinder, $\frac{1}{2} A (l_1 + l_2)$

Pyramid or Cone, right and regular



S = perimeter of base, P, x $\frac{1}{2}$ slant height l : $\frac{1}{2} Pl$.

V = area of base, B, x $\frac{1}{3}$ perpendicular ht., h : $\frac{1}{3} Bh$.

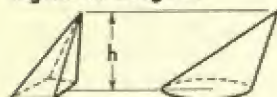
1.14 FINDING SURFACES AND VOLUMES OF SOLIDS (Cont.)

(S = lateral or convex surface; V = volume)

SHAPE

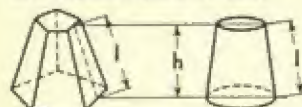
FORMULAS

Pyramid or Cone, right or oblique, regular or irregular



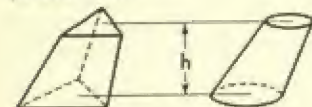
- $V = \text{area of base, } B, \times \frac{1}{3} \text{ perp. height, } h : \frac{1}{3} Bh.$
- $V = \frac{1}{3} \text{ vol. of prism or cylinder of same base } G \text{ perp. height.}$
- $V = \frac{1}{3} \text{ vol. of hemisphere of same base and perp. height.}$

Frustum of pyramid or cone, right and regular, parallel ends



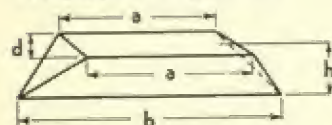
- $S = (\text{sum of perimeter of base, } P, \text{ and top, } p) \times \frac{1}{2} \text{ slant height } l : \frac{1}{2} l (P+p).$
- $V = (\text{sum of areas of base, } B, \text{ and top, } b, + \text{sq. root of their products}) \times \frac{1}{3} \text{ perp. height, } h : \frac{1}{3} h (B+b+\sqrt{Bb}).$

Frustum of any pyramid or cone, parallel ends



- $V = (\text{sum of areas of base, } B, \text{ and top, } b, + \text{sq. root of their products}) \times \frac{1}{3} \text{ perpendicular height, } h : \frac{1}{3} h (B+b+\sqrt{Bb}).$

Wedge, parallelogram face



- $V = \frac{1}{6} (\text{sum of three edges, } a+b, \times \text{perpendicular height, } h, \times \text{perpendicular width, } d) : \frac{1}{6} d h (2a+b)$

1.14 FINDING SURFACES AND VOLUMES OF SOLIDS (Cont.)

(S = lateral or convex surface; V = volume)

SHAPE

FORMULAS

Sphere



$$S = 4 \pi r^2 = \pi d^2 = 3.14159265 d^2.$$

$$V = \frac{4}{3} \pi r^3 = \frac{1}{6} \pi d^3 = 0.52359878 d^3.$$

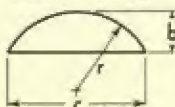
Spherical Sector



$$S = \frac{1}{2} \pi r (4b + c).$$

$$V = \frac{2}{3} \pi r^2 b.$$

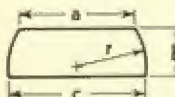
Spherical Segment



$$S = 2 \pi r b = \frac{1}{4} \pi (4b^2 + c^2).$$

$$V = \frac{1}{3} \pi b^2 (3r - b) = \frac{1}{24} \pi b (3c^2 + 4b^2).$$

Spherical Zone



$$S = 2 \pi r b.$$

$$V = \frac{1}{24} \pi b (3a^2 + 3c^2 + 4b^2).$$

Circular Ring



$$S = 4 \pi^2 R r.$$

$$V = 2 \pi^2 R r^2.$$

1.14 FINDING SURFACES AND VOLUMES OF SOLIDS (Cont.)

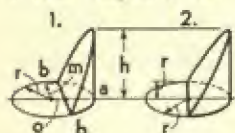
(S = lateral or convex surface; V = volume)

SHAPE

FORMULAS

Ungula of right, regular cylinder

1. Base = segment, bab. 2. Base = half circle



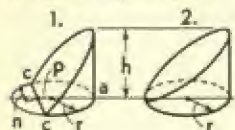
$$S = (2rm - o \times \text{arc,} \quad S = 2rh.$$

$$\text{bab}) \frac{h}{r-o}.$$

$$V = (\frac{2}{3}m^3 - o \times \text{area,} \quad V = \frac{2}{3}r^2h.$$

$$\text{bab}) \frac{h}{r-o}.$$

1. Base = segment, cac. 2. Base = circle



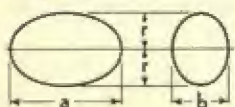
$$S = (2rn + p \times \text{arc,} \quad S = \pi rh.$$

$$\text{cac}) \frac{h}{r+p}.$$

$$V = (\frac{2}{3}n^3 + p \times \text{area,} \quad V = \frac{1}{2}r^2\pi h.$$

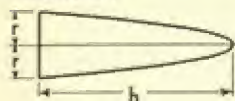
$$\text{cac}) \frac{h}{r+p}.$$

Ellipsoid



$$V = \frac{1}{3}\pi rab.$$

Paraboloid















$$V = \frac{1}{2}\pi r^2h.$$

Ratio of corresponding volume of
a Cone, Paraboloid, Sphere &
Cylinder of equal height: $\frac{1}{3}, \frac{1}{2},$
 $\frac{2}{3}, 1.$

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1.15 FINDING AREAS

FORM		METHOD OF FINDING AREAS
TRIANGLE		Base $\times \frac{1}{2}$ perpendicular height. $\sqrt{s(s-a)(s-b)(s-c)}$, $s = \frac{1}{2}$ sum of the three sides a, b, c .
TRAPEZIUM		Sum of area of the two triangles
TRAPEZOID		$\frac{1}{2}$ sum of parallel sides \times perpendicular height.
PARALLELOGRAM		Base \times perpendicular height.
REG. POLYGON		$\frac{1}{2}$ sum of sides \times inside radius.
CIRCLE		$\pi r^2 = 0.78540 \times \text{diam}^2 = 0.07958 \times \text{circumference}^2$.
SECTOR OF A CIRCLE		$\frac{\pi r^2 A^\circ}{360} = 0.0087266 r^2 A^\circ = \text{arc} \times \frac{1}{2} \text{ radius}$
SEGMENT OF A CIRCLE		$\frac{r^2}{2} \left(\frac{\pi A^\circ}{180} - \sin A^\circ \right)$
CIRCLE of same area as a square		Diameter = side $\times 1.12838$
SQUARE of same area as a circle		Side = diameter $\times 0.88623$
ELLIPSE		Long diameter \times short diameter $\times 0.78540$
PARABOLA		Base $\times \frac{1}{2}$ perpendicular height.

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1.16 WEIGHTS OF BUILDING MATERIALS

<u>Material</u>	<u>Weight, lb per cu ft</u>
Concrete, cinder	90-110
Concrete, slag	120-130
Concrete, stone, not reinforced	144
Concrete, stone, reinforced	150
Brickwork in place, medium to soft bricks	110
Brickwork in place, hard bricks	120-140
Sandstone masonry in place	130
Bluestone masonry in place	135
Limestone masonry in place	150
Marble in place	155
Granite in place	155
Lumber, softwood	30-33
Lumber, hardwood	35-45

1.17 WEIGHT OF EARTH MATERIALS IN THE GROUND

Material	Weight		To convert from cu yd to tons, multiply by
	Lb per cu ft	Lb per cu yd	
Ashes or cinders	45	1,215	0.608
Slag	70	1,890	0.945
Earth, compact	95	2,565	1.283
Earth, dry and loose	75	2,025	1.013
Earth, moist	80	2,160	1.080
Clay, very dry	75	2,025	1.013
Clay, dry	85	2,295	1.148
Clay, moist	95	2,565	1.283
Clay, wet	110	2,970	1.485
Clay and gravel mixed, dry	100	2,700	1.350
Crushed stone	95	2,565	1.283
Sand, loose and dry	95	2,565	1.283
Sand, moist	105	2,835	1.418
Sand, wet	115	3,105	1.553
Sand and gravel, dry	100	2,700	1.350
Sand and gravel, compact	110	2,970	1.485
Sand and gravel, wet	120	3,240	1.620
Gravel, loose and dry	100	2,700	1.350
Gravel, compact	115	3,105	1.553
Gravel, wet	125	3,375	1.688
Mud, flowing	110	2,970	1.485
Mud, compact	120	3,240	1.620
Sandstone	150	4,050	2.025
Limestone	160	4,320	2.160
Granite	165	4,455	2.228

These weights are approximate, being average figures; the weight of earth material varies according to its density and moisture content.

1.18 WEIGHTS OF MISCELLANEOUS MATERIALS

Substance	Weight, Pounds per Cu. Ft.	Substance	Weight, Pounds per Cu. Ft.
Metals, Alloys, Ores		Various Solids—Cont.	
Aluminum, cast-hammered	165	Porcelain, china	150
" bronze	481	Resins, Rosin, Amber	67
Antimony	416	Rubber, caoutchouc	58
Brass, cast-rolled	534	Silicon	155
Bronze, 7.9 to 14% Sn.	509	Sulphur, amorphous	128
Chromium	428	Wax	60
Copper, cast-rolled	556		
" ore, pyrites	262	Timber, U. S. Seasoned	
Gold, cast-hammered	1205	Ash, white-red	40
Iron, cast, pig	450	Cedar, white-red	22
" wrought	485	Chestnut	41
" steel	490	Cypress	30
" spiegel-eisen	468	Fir, Douglas spruce	32
" ferro-silicon	437	" eastern	25
" ore, hematite	325	Elm, white	45
" " " in bank	160-180	Hemlock	29
" " " loose	130-160	Hickory	49
" limonite	237	Locust	46
" magnetite	315	Maple, hard	43
" slag	172	" white	33
Lead	706	Oak, chestnut	54
" ore, galena	465	" live	59
Magnesium	109	" red, black	41
Manganese	456	" white	46
Mercury	848	Pine, Oregon	32
Molybdenum	562	" red	30
Nickel	545	" white	26
" monel metal	556	" yellow, long-leaf	44
Platinum, cast-hammered	1330	" " short-leaf	38
Silver, cast-hammered	656	Poplar	30
Tin, cast-hammered	459	Redwood, California	25
" babbit metal	443	Spruce, white, black	27
" ore, cassiterite	418	Walnut, black	38
Tungsten	1180	" white	26
Vanadium	350	Moisture Contents:	
Zinc, cast-rolled	440	Seasoned timber 15 to 20%	
" ore, blende	253	Green timber up to 50%	
Various Solids		Various Liquids	
Carbon, amorphous, gra- phitic	129	Alcohol, 100%	49
Cork	15	Acids, muriatic 40%	75
Ebonv	76	" nitric 91%	94
Fats	58	" sulphuric 87%	112
Glass, common, plate	160	Lye, soda 66%	106
" crystal	184	Oils, vegetable	58
" flint	220	" mineral, lubricants	57
Phosphorus, white	114		

1.16 WEIGHTS OF MISCELLANEOUS MATERIALS (Cont.)

Substance	Weight, Pounds per Cu. Ft.	Substance	Weight, Pounds per Cu. Ft.
Various Liquids—Cont.		Bituminous Substances —Cont.	
Petroleum	55	Coal, charcoal, pine	23
Gasoline	42	" " oak	33
Water, 4° C, max. density	62.428	" coke	75
" 100° C	59.830	Graphite	131
" ice	56	Paraffin	56
" snow, fresh fallen	8	Petroleum, crude	55
" sea water	64	" refined	50
		" benzine	46
		" gasolene	42
		Pitch	69
		Tar, bituminous	75
Minerals		Coal and Coke, Piled	
Asbestos	153	Coal, anthracite	47-58
Barytes	281	" bituminous, lignite	40-54
Basalt	184	" peat, turf	20-26
Bauxite	159	" charcoal	10-14
Borax	109	" coke	23-32
Chalk	137		
Clay, marl	137	Earth, etc., Excavated	
Dolomite	181	Clay, dry	63
Feldspar, orthoclase	159	" damp, plastic	110
Gneiss, serpentine	159	Clay and gravel, dry	110
Granite, syenite	175	Earth, dry, loose	76
Greenstone, trap	187	" " packed	95
Gypsum, alabaster	159	" moist, loose	78
Hornblende	187	" " packed	96
Limestone, marble	165	" mud, flowing	108
Magnetite	187	" " packed	115
Phosphate rock, apatite	200	Riprap, limestone	80-85
Porphyry	172	" sandstone	90
Pumice, natural	40	" shale	105
Quartz, flint	165	Sand, gravel, dry, loose	90-105
Sandstone, bluestone	147	" " " packed	100-120
Shale, slate	175	" " " wet	118-120
Soapstone, talc	169		
Stone, Quarried, Piled		Excavations in Water	
Basalt, granite, gneiss	96	Sand or gravel	60
Limestone, marble, quartz	95	" " and clay	65
Sandstone	82	Clay	80
Shale	92	River mud	90
Greenstone, hornblende	107	Soil	70
		Stone riprap	65
Bituminous Substances			
Asphaltum	81		
Coal, anthracite	97		
" bituminous	84		
" lignite	78		
" peat, turf, dry	47		

1.19 DEAD WEIGHTS OF FLOORS, CEILINGS, AND ROOFS

FLOORINGS:—

Weight (pcf)

Cement finish, per inch of thickness	12
Cinder concrete fill, per inch of thickness	8
3" creosoted wood blocks on $\frac{1}{2}$ " mortar base	21
2" creosoted wood blocks on $\frac{1}{2}$ " mortar base	17
3" creosoted wood blocks on $\frac{3}{4}$ " mastic bed	12
2" creosoted wood blocks on $\frac{3}{4}$ " mastic bed	9
$\frac{3}{4}$ " hardwood floor on sleepers clipped to concrete without fill	5
$1\frac{1}{2}$ " terrazzo floor finish directly on slab	19
$1\frac{1}{2}$ " terrazzo floor finish on 1" mortar bed	30
1" terrazzo finish on 2" concrete bed	38
$\frac{3}{4}$ " ceramic or quarry tile on $\frac{1}{2}$ " mortar bed	16
$\frac{3}{4}$ " ceramic or quarry tile on 1" mortar bed	22
$\frac{3}{4}$ " linoleum or asphalt tile directly on concrete	1
$\frac{3}{4}$ " linoleum or asphalt tile on 1" mortar bed	12
$\frac{3}{4}$ " mastic floor	9
Hardwood flooring, $\frac{3}{4}$ " thick	4
Subflooring (soft wood), $\frac{1}{2}$ " thick	2½
Gypsum slab, per inch of thickness	6
Asphalt mastic finish, $1\frac{1}{4}$ in. thick	18

CEILINGS:—

$\frac{3}{4}$ " plaster directly on concrete, blocks or tile	5
$\frac{3}{4}$ " plaster on metal lath furring	8
$\frac{3}{4}$ " gypsum plaster on metal lath and channel suspended ceiling construction	10
Plaster on rock lath and channel ceiling construction	6
Acoustical fiber tile directly on concrete blocks or tile	1
Acoustical fiber tile on rock lath and channel ceiling construction	5
Acoustical fiber tile on suspended wood furring strips	3

ROOFS:—

Five-ply felt and gravel (or slag)	6½
Three-ply felt and gravel (or slag)	5½
Five-ply felt composition roof, no gravel	4
Three-ply felt composition roof, no gravel	3
Asphalt strip shingles	3
Cement tile	18
Slate, $\frac{1}{4}$ " thick	9½
Slate, $\frac{1}{2}$ " thick	19
Sheathing, $\frac{1}{2}$ " thick, Yellow Pine	3½
Sheathing, $\frac{3}{4}$ " thick, Spruce or Hemlock	2½
Skylight with galvanized iron frame, $\frac{1}{4}$ " wire glass	7
Gypsum, per inch of thickness	4
Poured gypsum on steel rails, per inch of thickness	5
Light-weight fill or insulation, porous glass, vermiculite, etc., per inch of thickness	1 to 2
Light-weight fill or insulation, cinder concrete, per inch of thickness	8
Spanish tile (laid)	9 to 12
Shingle-type clay tile	12 to 14
Metal deck (20 gauge)	2½
Metal deck (18 gauge)	3
Corrugated metal (20 gauge)	1½
Flat cement tile, per inch of thickness	13

Portland cement may be shipped in bulk or in sacks weighing 94 lb per sack, ordinarily considered 1 cu ft (4 sacks = 376 lb are referred to as a barrel).

CONCRETE REINFORCING STEEL INSTITUTE

1.20 DEAD WEIGHTS OF WALLS AND PARTITIONS

	Weight (psf)		
	Un-plastered	One Side Plastered	Both Sides Plastered
WALLS:—			
4" brick wall.....	40	45	50
9" brick wall.....	80	85	90
13" brick wall.....	120	125	130
17" brick wall.....	160	165	170
21" brick wall.....	205	210	215
25" brick wall.....	245	250	255
4" concrete block.....	28	33	38
6" concrete block.....	36	41	46
8" concrete block.....	51	56	61
12" concrete block.....	59	64	69
4" hollow light-weight block (tile or cinder).....	19	24	29
6" hollow light-weight block (tile or cinder).....	22	27	32
8" hollow light-weight block (tile or cinder).....	33	38	43
12" hollow light-weight block (tile or cinder).....	44	49	54
4" brick, 4" hollow concrete block backing.....	68	73	—
4" brick, 8" hollow concrete block backing.....	91	96	—
4" brick, 12" hollow concrete block backing.....	119	124	—
4" terra cotta tile.....	25	30	35
8" terra cotta tile.....	33	38	43
12" terra cotta tile.....	45	50	55
4" glass block.....	20	—	—
Windows, glass, frame and sash.....	8	—	—
Porcelain enamel on sheet steel.....	3	—	—
Structural glass, per inch of thickness.....	15	—	—
4" stone.....	55	—	—
Asbestos hardboard (corrugated), per $\frac{1}{4}$ " of thickness.....	3	—	—
4" brickwork with 4" hollow tile backing.....	60	65	—
4" brickwork with 8" hollow tile backing.....	75	80	—
PARTITIONS:—			
3" clay tile.....	17	22	27
4" clay tile.....	18	23	28
6" clay tile.....	25	30	35
8" clay tile.....	31	36	41
10" clay tile.....	35	40	45
3" gypsum block.....	10	15	20
4" gypsum block.....	13	18	23
5" gypsum block.....	16	21	26
6" gypsum block.....	17	22	27
2" solid plaster.....	—	—	20
2 x 4 studs, or metal studs, lath and $\frac{3}{4}$ " plaster.....	—	—	18
Steel partitions.....	4	—	—
$\frac{1}{4}$ " plaster on gypsum block or clay tile.....	—	4	8

Partitions are sometimes arbitrarily allowed for as 12, 15, or 18 psf of floor area, which, at best, is not very precise. It is better to take off and weigh the partitions in a panel or two for any building of importance.

CONCRETE REINFORCING STEEL INSTITUTE

1.21 BUILDING CODE REQUIREMENTS FOR LIVE LOADS (In pounds per square foot)

Occupancy	Codes								
	Basic Building Code BOCA 1950	Am. Std. Bldg. Code 1945 Nat. Bureau of Stds.	Nat. Bld. of Fire Underwriters 1940	Pacific Coast Bldg. Officials Conference 1952	New York 1946	Chicago 1950	Phila. delphia 1949	Detroit	Southern Building Code Congress Southern Bldg. Code 1950
Dwellings, apartment and tenement houses, hotels, club houses, hospitals and places of detention: Dwellings, private rooms and apartments Public corridors, lobbies and dining rooms	40 20 100 20	40 100	40 100	40 100	40 11 100	40 100	40 100	40 80	40 11 100
School buildings: Class rooms and rooms for similar use Corridors and public parts of the building	60 21 100	40 100	40 100	40 1 100	60 12 100	40 100	50 25 100	50 25 80	40 100
Theaters, assembly halls and other places of assembly: Auditoriums with fixed seats Lobbies, passageways, gymnasiums, grandstands, stages, and auditoriums or places of assembly without fixed seats Stage floor	60 100 150	60 100 150	60 100 150	50 100 2 100	75 11 100 150	60 100 150	60 26 100 150	80 100 22 100	50 100
Office building: Office space Corridors and other public places	50 2 100 4	80 100	80 80	50 2,3 100	50 11 100 42	50 11 100	60 100	50 24 125 14	50 100

1.21 BUILDING CODE REQUIREMENTS FOR LIVE LOADS (Cont.)

Occupancy	Codes								
	Basic Building Code BOCA 1950	Amer. Inst. of Bldg. Code 1945 Nat. Bureau of Sds.	Nat. Bld. Code Underwriters 1949	Pacific Coast Bldg. Officials Conference 1952	New York 1946	Chicago 1950	Philadelphia 1949	Detroit	Southern Building Code Congress Southern Bldg. Code 1950
Workshops, factories and mercantile establishments.	120	125	125 *	75	120	100	120	100	100
	120		125 *	125	120	100	200	125	150
	250			250	120		120-150	150	250
	75	125	125 *	75	75		200	100	75
	120	125	250 *	100	75		100	100	100
Garages:	175		100 *	100 *	175	100	100 *	150	120
	75		100 *	100	75	50	75	80	120
All types of vehicles Passenger cars only	100			100	100	100	100	100	100
	20-100		20	20 *	40	25	30	30	20
	250 *		250	250 *	300		150	250	250
	Min 20 to			15-20 *	0-20	15-25	15-25	20	10-20 *
All stairs and fire escapes, except in private residences									
Roofs (flat)									
Sidewalks									
Wind									

1.21 BUILDING CODE REQUIREMENTS FOR LIVE LOADS (Cont.)

- 1 15 psf up to 60 ft high, 20 psf over 60 ft.
- 2 Or 2000 on any space $3\frac{1}{2}$ feet square.
- 3 Where partitions are subject to change, add 20 psf to all other loads.
- 4 Or 8000 concentrated.
- 5 If area is 200 to 600 sf use 16 psf, over 600 sf, 12 psf; for rise 4 in. per ft use 16 psf under 200 sf, 14 psf for 200-600 sf and 12 psf over 600 sf; for rise 12 in. per ft use 12 psf.
- 6 15 for portions below 40 ft and 30 for portions above 40 ft.
- 7 60 for library reading rooms and 150 for stackrooms.
- 8 150 for armories.
- 9 Or concentrated rear wheel of loaded truck in any position.
- 10 Increase 0.025 psf for each foot above 100 ft.
- 11 Including corridors.
- 12 For rooms with fixed seats or, by special permission, other small rooms, 120 for library stackrooms.
- 13 60 for churches.
- 14 Including entire first floor.
- 15 100 for entire first floor.
- 16 Or 6000 concentrated. Trucking space, 150% max. wheel load; 175 psf on floor construction, 120 psf on beams and girders.
- 17 Or 2000 concentrated.
- 18 Or 12,000 concentrated for driveways over sidewalks.
- 19 20 psf from top down to 100 ft level, zero below; 50 psf on tanks, stacks and exposed structures.
- 20 100 psf on floor at grade, upper floors 75 psf.
- 21 Or 2000 concentrated on any space 3 feet square.
- 22 Or 3000 concentrated on any space 4 feet square.
- 23 100 on first floor and alternate of 3000 on area 4 feet square.

Courtesy Concrete Reinforcing Steel Institute

- 24 25 for surfaces less than 275 ft high and 35 psf above.
- 25 Only school class rooms with fixed seats.
- 26 Churches only.
- 27 Fixed seats, 60 psf; removable seats, 100 psf.
- 28 Every floor beam 4000 concentrated.
- 29 Other than residential, 100 psf; hotels and multifamily, 60 psf.
- 30 On first floor, 40 psf; upper floors, 30 psf.
- 31 Interior courts, sidewalks, etc., not accessible to a driveway.
- 32 15 psf up to 50 ft high, 20 psf from 50 to 200 ft, 25 psf over 200 ft high. Roofs over 30°, 20 psf on windward side, 10 psf on leeward.
- 33 125 for dance halls and drill halls.
- 34 Above first floor including corridors.
- 35 125 for first floor.
- 36 150 for first floor.
- 37 Or 2500 concentrated on area 6 inches square with such concentrations spaced alternately 2 ft 4 in. and 4 ft 8 in. in one direction and 5 ft and 10 ft in the other direction.
- 38 Only structures with clear head room of 8 ft 6 in. or less. Or 1500 concentrated spaced as in 37.
- 39 50 for dwellings and apartments under 3 stories.
- 40 For buildings less than 500 ft high.
- 41 The minimum for storage or manufacturing is 120 psf, but floors must be designed for any heavier loads contemplated and for any concentrations.
- 42 Including entire first floor but not including corridors on floors used for offices.
- 43 30 for one and two family dwellings.
- 44 10 for portions below 40 ft and 20 for portions above 40 ft.

1.22 STRENGTH OF MATERIALS

METALS AND ALLOYS

Material	Stress in Kips per Square Inch					Modulus of Elasticity Pounds per Sq. In.	Elongation Per cent
	Tension Ultimate	Elastic Limit	Compression Ultimate	Bending Ultimate	Shearing Ultimate		
Aluminum, bars, sheets.....	24-28	12-14					
" wire, annealed.....	20-35	14					
Brass, 50% Zn.....	31	17.9	117	33.5			5.0
" cast, common.....	18-24	6	30	20	36	9,000,000	
" wire, hard.....	80						
" annealed.....	50	16				14,000,000	
Bronze, aluminum 5 to 7½%.....	75	40	120				
" Tobin, cast } 38% Zn	66						
" " rolled } 1½% Sn	80	40				14,500,000	
" " c. " } ½% Pb	100						
Copper, plates, rods, bolts.....	32-35	10	32				
Iron, cast, gray.....	18-24						
" malleable.....	27-35	15-20	46	30	40		
" wrought, shapes.....	48	26	Tensile	Tensile	½ Tens.	28,000,000	
Steel, plates for cold pressing.....	48-58	½ Tens.	Tensile	Tensile	½ Tens.	29,000,000	
" cars.....	50-65	½ Tens.	Tensile	Tensile	½ Tens.	29,000,000	
" locos., stat. boilers.....	55-65	½ Tens.	Tensile	Tensile	½ Tens.	29,000,000	
" bridges and bldgs., ships.....	60-72	33	Tensile	Tensile	½ Tens.	29,000,000	
" structural silicon.....	80-95	45	Tensile	Tensile	½ Tens.	29,000,000	
" struc. nickel (3.25% Ni).....	85-100	50	Tensile	Tensile	½ Tens.	29,000,000	
Steel, rivet, boiler.....	45-65	½ Tens.	Tensile	Tensile	½ Tens.	29,000,000	
" br., bldg. loco., cars.....	52-62	28	Tensile	Tensile	½ Tens.	29,000,000	
" ships.....	55-65	30	Tensile	Tensile	½ Tens.	29,000,000	
" high-tensile.....	70-85	38	Tensile	Tensile	½ Tens.	29,000,000	
Steel, cast, soft.....	60	27	Tensile	Tensile	½ Tens.	29,000,000	124
" medium.....	70	31.5	Tensile	Tensile	½ Tens.	29,000,000	120
" hard.....	80	36	Tensile	Tensile	½ Tens.	29,000,000	117
Steel wire, unannealed.....	120	60					
" annealed.....	80	40					
" bridge cable.....	215	95					

* 1,000,000
Tensile Strength

* 8" gage length
1 1/2" gage length

BUILDING MATERIALS

Material	Average Ultimate Stress Pounds per Square Inch			Safe Working Stress Pounds per Square Inch			Modulus of Elasticity Pounds per Sq. In.
	Compression	Tension	Bending	Compression	Bearing	Shearing	
Masonry, granite.....				420	600		
" limestone, bluestone.....				350	500		
" sandstone.....				280	400		
" rubble.....				140	250		
" brick, common.....	10000	200	600				
Ropes, cast steel hoisting.....		80000					
" standing, derrick.....		70000					
" manila.....		8000					
Stone, bluestone.....	12000	1200	2500	1200	1200	200	7,000,000
" granite, gneiss.....	12000	1300	1600	1200	1200	200	7,000,000
" limestone, marble.....	8000	800	1500	800	800	150	7,000,000
" sandstone.....	5000	150	1200	500	500	150	3,000,000
" slate.....	10000	3000	5000	1000	1000	175	14,000,000

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

1.23 FLOOR SPACE REQUIREMENTS FOR FARM PRODUCTS

Product	Weight per cu ft, lb	Floor space per bag or barrel, sq ft	Cubic feet per bag or barrel
Barley, in bulk	37		
Corn, in bulk	37		
Corn, in bags	31	3.6	3.6
Oats, in bulk	32		
Oats, in bags	27	3.3	3.6
Rye, in bulk	48		
Wheat, in bulk	44		
Wheat, in bags	39	4.2	4.2
Rice, in bags	58		
Flour, in barrels (laid on side)	40	4.1	5.4
Cornmeal, in barrels	37	3.7	5.9
Hay, loose	4		
Hay, baled	13		
Straw, baled	19		
Apples, pears, etc., in bulk	38		
Potatoes, turnips, etc., in bulk	44		

1.24 BEAUFORT SCALE FOR WIND VELOCITY

Beau- fort scale No.	Description	Indicators of velocity	Velocity, mph
0	Calm	Calm air; smoke rises vertically	Less than 1
1	Light air	Direction of wind shown by smoke drift but not by wind vanes	1-3
2	Slight breeze	Wind felt on face; leaves rustle; ordi- nary vane moved by wind	4-7
3	Gentle breeze	Leaves and small twigs in constant mo- tion; wind extends light flag	8-12
4	Moderate breeze	Raises dust and loose paper; small branches are moved	13-18
5	Fresh breeze	Small trees in leaf sway; crested wave- lets form on inland waters	19-24
6	Strong breeze	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty	25-31
7	High wind	Whole trees in motion; inconvenience when walking against wind	32-38
8	Gale	Breaks twigs off trees; wind generally impedes progress	39-46
9	Strong gale	Slight structural damage occurs to signs; branches broken	47-54
10	Whole gale	Trees uprooted or broken; considerable structural damage occurs	55-63
11	Storm	Very rarely experienced; accompanied by widespread damage	64-75
12	Hurricane		Above 75

1.25 NORMAL TEMPERATURES, HIGHS, LOWS; PRECIPITATION (Courtesy World Almanac 1962, New York World Telegram)

Source: Weather Bureau, United States Department of Commerce

These normals are based on records for the thirty-year period 1921 to 1950 inclusive.

Extreme temperatures are based on the period of record through 1960.

AP indicates airport station; those not so marked are city office stations.

The minus (—) sign indicates temperatures below zero. Fahrenheit thermometer registration.

State	Station	Normal temperature				Extreme temperature		Normal annual precipitation
		January		July		High-est	Lowest	
		Max.	Min.	Max.	Min.			
Alabama.....	Mobile (AP).....	62	43	89	72	104	11	67.57
Alabama.....	Montgomery (AP).....	60	39	91	71	105	8	53.85
Alaska.....	Juneau (AP).....	31	21	62	47	84	-21	56.05
Arizona.....	Phoenix (AP).....	65	35	105	75	118	17	7.19
Arkansas.....	Little Rock (AP).....	51	32	93	71	107	-5	47.38
California.....	Los Angeles.....	65	45	83	62	110	28	14.64
California.....	San Francisco (AP).....	56	40	69	52	104	20	17.54
Colorado.....	Denver (AP).....	42	16	87	58	104	-30	14.22
Connecticut.....	New Haven (AP).....	37	21	80	62	100	-8	45.10
Delaware.....	Wilmington (AP).....	42	25	87	65	102	-4	44.50
Dist. of Col.....	Washington (AP).....	44	29	87	68	103	1	40.57
Florida.....	Jacksonville (AP).....	66	45	91	73	105	17	52.18
Florida.....	Key West (AP).....	75	61	89	78	95	46	39.21
Florida.....	Miami (AP).....	78	59	91	74	98	32	56.48
Georgia.....	Atlanta (AP).....	53	37	89	70	103	3	49.34
Hawaii.....	Honolulu (AP).....	78	62	91	59	93	55	140.35
Idaho.....	Boise (AP).....	35	20	82	67	111	-17	11.52
Illinois.....	Chicago (AP).....	33	17	85	64	104	-15	32.72
Indiana.....	Indianapolis (AP).....	37	20	88	64	104	-19	39.77
Iowa.....	Des Moines (AP).....	31	14	87	66	105	-21	30.79
Iowa.....	Dubuque (AP).....	27	12	84	63	99	-26	32.89
Kansas.....	Wichita (AP).....	41	23	92	69	113	-10	30.74
Kentucky.....	Louisville (AP).....	44	26	89	67	105	-19	41.00
Louisiana.....	New Orleans.....	64	48	90	76	102	7	63.70

State	Station	Normal temperature				Extreme temperature		Normal annual precipitation
		January		July		High-est	Lowest	
		Max.	Min.	Max.	Min.			
Maine.....	Eastport.....	30	14	69	52	93	-23	39.24
Maine.....	Portland (AP).....	31	11	79	57	100	-39	41.91
Maryland.....	Baltimore.....	44	30	87	70	107	-7	42.59
Massachusetts.....	Boston (AP).....	37	22	80	64	100	-12	38.86
Michigan.....	Detroit City (AP).....	33	19	84	63	105	-16	31.11
Michigan.....	Sault Ste. Marie (AP)....	22	6	75	52	98	-25	30.24
Minnesota.....	Minn.-St. Paul (AP).....	23	6	85	64	104	-31	24.75
Mississippi.....	Vicksburg.....	58	41	90	73	101	6	49.82
Missouri.....	St. Louis (AP).....	41	24	90	69	99	-5	36.80
Montana.....	Helena (AP).....	27	8	84	52	102	-42	11.32
Nebraska.....	Omaha (AP).....	32	14	89	68	114	-21	25.94
Nevada.....	Winnemucca (AP).....	37	18	92	56	105	-19	8.78
N. Hampshire.....	Concord (AP).....	32	9	83	55	102	-37	37.32
New Jersey.....	Atlantic City (AP).....	43	26	83	66	98	-6	40.12
New Mexico.....	Albuquerque (AP).....	46	22	92	66	104	-5	8.70
New Mexico.....	Roswell (AP).....	54	25	92	66	110	-15	12.09
New York.....	Albany (AP).....	31	14	83	60	100	-26	31.89
New York.....	New York.....	40	26	82	67	102	-14	42.03
No. Carolina.....	Charlotte (AP).....	52	32	89	68	104	-3	43.23
No. Carolina.....	Raleigh (AP).....	51	32	89	68	105	-7	45.19
No. Dakota.....	Bismarck (AP).....	20	-2	86	59	109	-44	15.42
Ohio.....	Cincinnati.....	41	25	88	66	109	-17	39.42
Ohio.....	Cleveland (AP).....	36	21	85	63	103	-9	32.24
Oklahoma.....	Oklahoma City (AP)....	47	28	93	71	104	-4	30.27
Oregon.....	Portland.....	44	35	79	58	107	3	40.09
Pennsylvania.....	Harrisburg (AP).....	39	2	86	65	102	-8	36.09
Pennsylvania.....	Philadelphia (AP).....	41	25	87	66	102	1	41.23
Rhode Island.....	Block Island (AP).....	38	26	75	63	91	-1	38.74
So. Carolina.....	Charleston (AP).....	61	39	89	71	103	14	48.25
So. Dakota.....	Huron (AP).....	25	2	90	61	110	-34	17.56
So. Dakota.....	Rapid City (AP).....	33	9	86	59	109	-27	17.12
Tennessee.....	Nashville (AP).....	49	31	91	69	107	-15	45.19
Texas.....	Amarillo (AP).....	49	22	92	64	108	-14	21.15

1.25 NORMAL TEMPERATURES (Cont.)

State	Station	Normal temperature				Extreme temperature		Normal annual precipitation
		January		July		High-est	Lowest	
		Max.	Min.	Max.	Min.			
Texas.....	Galveston (AP).....	60	48	89	78	97	8	48.08
Texas.....	Houston.....	62	46	92	75	105	10	45.46
Utah.....	Salt Lake City (AP).....	36	17	92	61	107	-30	14.79
Vermont.....	Burlington (AP).....	28	8	82	58	101	-30	32.27
Virginia.....	Norfolk (AP).....	50	33	86	69	103	11	43.37
Washington.....	Seattle.....	45	36	75	56	100	11	32.05
Washington.....	Spokane (AP).....	30	20	82	57	102	-24	14.97
West Virginia.....	Parkersburg.....	43	26	86	65	106	-27	39.21
Wisconsin.....	Madison (AP).....	28	10	86	60	102	-37	30.05
Wisconsin.....	Milwaukee (AP).....	29	15	81	61	101	-24	27.62
Wyoming.....	Cheyenne (AP).....	37	14	83	54	100	-34	16.28
Puerto Rico.....	San Juan.....	80	70	84	76	96	62	60.07

Mean Annual Snowfall (Inches)—Denver, Colo., 55.6; Eastport, Me., 71.6; Boston, Mass. (AP), 42.1; Detroit, Mich. (AP), 28.7; Sault Ste. Marie, Mich., 102.1; Minneapolis-St. Paul, 42.7; Helena, Montana, 45.9; Albany, N. Y. (AP), 57.2; Rochester, N. Y., 75.3; Cleveland, Ohio (AP), 52.6; Salt Lake City (AP), 51.9; Burlington, Vt., 65.0; Cheyenne, Wyo., 58.0; Juneau, Alaska (AP), 96.9.

Wettest Spot: Mount Waialeale, Hawaii, on the island of Kauai, is the rainiest place in the world, according to the National Geographic Society, with an average annual rainfall of 471.68 inches.

Highest Temperature: A temperature of 136° F. observed at Azizla, Tripolitania in Northern Africa on Sept. 13, 1923 is generally accepted as the world's highest temperature recorded under standard conditions.

The record high in the United States was 134° in Death Valley, Calif., July 10, 1913.

Lowest Temperature: The U. S. National Committee for the ICY reported that a record low temperature of -125.3° F. (-87.4° C.) was recorded at the Soviet Antarctic station Vostok on Aug. 25, 1958.

The record low in the United States was -69.7° at Rogers Pass, Mont., Jan. 20, 1954.

The lowest official temperature on the North American continent was recorded at 81 degrees below zero in February, 1947, at a lonely airport in the Yukon called Snag.

These are the meteorological champions—the official temperature extremes—but there are plenty of other claimants to thermometer fame. However, sun readings are unofficial records, since meteorological data to qualify officially must be taken on instruments in sheltered and ventilated locations.

1.26 MONTHLY NORMAL TEMPERATURE AND PRECIPITATION

(Courtesy World Almanac 1962, New York World Telegram)

Source: Weather Bureau, United States Department of Commerce

These normals are based on records for the thirty-year period 1921 to 1950 inclusive. For stations that did not have continuous records from the same instrument site for the entire 30 years, the means have been adjusted to the record at the present site.

AP indicates airport station; those not so marked are city office stations.

T, Temperature in Fahrenheit; P, precipitation in inches; L, less than .05 inch.

Stations	Jan.		Feb.		Mar.		Ap.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.
Albany, N. Y. (AP)...	23.2	3.3	23.2	3.3	33.2	3.3	45.2	2.6	58.2	2.8	67.3	3.4	71.3	3.3	70.2	2.9	62.3	2.5	51.2	2.2	39.2	2.7	26.2	1.3
Albuquerque, N. M.	34.3	3.3	39.3	3.3	46.4	1.0	55.4	1.4	64.3	3.0	74.3	3.2	77.3	1.4	77.1	1.4	70.1	1.0	58.1	1.4	44.4	1.4	36.5	1.4
Amarillo, Texas.....	35.6	4.0	40.6	4.0	46.1	1.0	56.1	1.4	64.3	3.0	74.3	3.2	77.3	1.4	77.1	1.4	70.1	1.0	58.1	1.4	44.4	1.4	36.5	1.4
Anchorage, Alaska.....	13.8	19.6	25.6	19.6	36.6	19.6	46.6	19.6	55.6	19.6	64.6	19.6	74.6	19.6	84.6	19.6	94.6	19.6	104.6	19.6	114.6	19.6	124.6	19.6
Asheville, N. C.	39.3	3.0	41.2	3.0	47.3	3.0	55.3	2.9	63.3	3.0	71.3	3.5	79.3	4.5	87.3	4.5	95.3	4.5	103.3	4.5	111.3	4.5	119.3	4.5
Atlanta, Ga.	45.4	4.7	46.4	4.7	53.5	6.1	61.2	7.0	70.3	7.8	80.3	8.7	90.3	9.6	100.3	10.5	110.3	11.4	120.3	12.3	130.3	13.2	140.3	14.1
Baltimore, Md.	37.3	3.7	37.3	3.7	45.3	5.4	54.3	6.3	63.3	7.2	72.3	8.1	81.3	9.0	90.3	9.9	99.3	10.8	108.3	11.7	117.3	12.6	126.3	13.5
Barrow, Alaska.....	-15.2	18.1	-15.2	18.1	-15.2	18.1	-15.2	18.1	-15.2	18.1	-15.2	18.1	-15.2	18.1	-15.2	18.1	-15.2	18.1	-15.2	18.1	-15.2	18.1	-15.2	18.1
Birmingham, Ala.	46.5	5.0	48.5	5.2	54.6	6.3	62.4	7.0	70.3	7.7	78.3	8.4	86.3	9.1	94.3	9.8	102.3	10.5	110.3	11.2	118.3	11.9	126.3	12.6
Bismarck, N. D.	9.4	13.4	27.4	13.4	37.4	13.4	47.4	13.4	57.4	13.4	67.4	13.4	77.4	13.4	87.4	13.4	97.4	13.4	107.4	13.4	117.4	13.4	127.4	13.4
Boise, Idaho (AP)....	27.1	3.3	34.3	3.3	42.3	3.5	50.3	3.8	58.3	4.1	66.3	4.4	74.3	4.7	82.3	5.0	90.3	5.3	98.3	5.6	106.3	5.9	114.3	6.2
Boston, Mass. (AP)....	29.3	3.3	29.3	3.3	38.3	3.4	47.3	3.5	56.3	3.6	65.3	3.7	74.3	3.8	83.3	3.9	92.3	4.0	101.3	4.1	110.3	4.2	119.3	4.3
Brownsville, Tex. (AP)	60.1	1.5	64.1	1.2	68.1	1.7	72.1	1.4	76.1	1.1	80.1	0.8	84.1	0.5	88.1	0.2	92.1	0.0	96.1	0.0	100.1	0.0	104.1	0.0
Buffalo, N. Y. (AP)...	25.2	6.8	25.2	6.8	33.2	7.4	41.2	8.0	49.2	8.6	57.2	9.2	65.2	9.8	73.2	10.4	81.2	11.0	89.2	11.6	97.2	12.2	105.2	12.8
Burlington, Vt. (AP)...	18.1	1.9	18.1	1.9	26.1	2.2	34.1	2.5	42.1	2.8	50.1	3.1	58.1	3.4	66.1	3.7	74.1	4.0	82.1	4.3	90.1	4.6	98.1	4.9
Charleston, S. C. (AP)...	50.2	2.5	52.3	2.1	54.4	2.8	56.5	3.1	58.6	3.4	60.7	3.7	62.8	4.0	64.9	4.3	67.0	4.6	69.1	4.9	71.2	5.2	73.3	5.5
Chicago, Ill. (AP)....	25.1	1.8	27.1	1.4	37.2	3.8	48.2	4.8	59.2	5.8	70.2	6.8	81.2	7.8	92.2	8.8	103.2	9.8	114.2	10.8	125.2	11.8	136.2	12.8
Cincinnati, Ohio.....	35.3	3.4	36.2	3.5	44.3	3.5	53.3	3.6	62.3	3.7	71.3	3.8	80.3	3.9	89.3	4.0	98.3	4.1	107.3	4.2	116.3	4.3	125.3	4.4
Cleveland, Ohio (AP)...	29.2	4.4	29.2	4.4	37.2	4.7	47.2	5.0	57.2	5.3	67.2	5.6	77.2	5.9	87.2	6.2	97.2	6.5	107.2	6.8	117.2	7.1	127.2	7.4
Columbus, Ohio.....	31.2	2.8	33.2	2.1	41.2	3.1	51.2	3.2	61.2	3.3	71.2	3.4	81.2	3.5	91.2	3.6	101.2	3.7	111.2	3.8	121.2	3.9	131.2	4.0
Dallas, Texas (AP)....	46.2	5.5	50.2	5.6	54.2	5.7	58.2	5.8	62.2	5.9	66.2	6.0	70.2	6.1	74.2	6.2	78.2	6.3	82.2	6.4	86.2	6.5	90.2	6.6
Davenport, Iowa.....	24.1	1.6	28.1	1.3	32.1	1.5	36.1	1.7	40.1	1.9	44.1	2.1	48.1	2.3	52.1	2.5	56.1	2.7	60.1	2.9	64.1	3.1	68.1	3.3
Denver, Colo. (AP)...	31.5	3.4	34.6	3.9	39.1	4.2	44.1	4.5	49.1	4.8	54.1	5.1	59.1	5.4	64.1	5.7	69.1	6.0	74.1	6.3	79.1	6.6	84.1	6.9
Des Moines, Iowa (AP)	23.1	2.2	27.1	1.1	31.1	2.0	35.1	2.4	39.1	2.8	43.1	3.2	47.1	3.6	51.1	4.0	55.1	4.4	59.1	4.8	63.1	5.2	67.1	5.6
Detroit, Mich. (AP)...	26.2	1.1	27.2	1.0	35.2	1.5	45.2	1.8	55.2	2.1	65.2	2.4	75.2	2.7	85.2	3.0	95.2	3.3	105.2	3.6	115.2	3.9	125.2	4.2
Dodge City, Kan. (AP)	30.5	3.8	35.8	4.1	41.1	4.4	46.4	4.7	51.7	5.0	57.0	5.3	62.3	5.6	67.6	5.9	72.9	6.2	78.2	6.5	83.5	6.8	88.8	7.1

1.26 MONTHLY NORMAL TEMPERATURE AND PRECIPITATION (Cont.)

Stations	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.
Duluth, Minn. (AP)...	8	1.2	11	1.3	22	1.8	37	2.5	50	3.2	60	4.3	66	3.6	65	3.4	55	3.2	44	2.2	27	1.8	13	1.2
Eastport, Maine.....	22	3.2	22	2.7	30	2.9	39	2.6	48	2.5	55	2.9	61	2.9	61	2.9	56	3.2	48	3.4	38	3.7	26	3.1
Eureka, Calif.....	47	6.2	48	5.6	49	4.6	51	2.9	53	1.8	56	1.7	56	1.5	57	1.5	56	3.2	48	2.7	51	4.6	49	6.1
Fairbanks, Alaska (AP)...	-10	1.0	-3	.5	9	.6	29	3.4	37	1.8	59	1.4	61	1.9	56	2.3	45	1.2	27	.9	3	.6	-9	.5
Fresno, Calif. (AP)....	45	1.6	51	1.7	55	1.6	61	1.0	69	3.7	71	3.7	71	1.8	79	1.3	73	1.6	74	3.6	73	.9	46	1.6
Galveston, Texas.....	54	4.1	57	2.9	62	3.1	69	3.1	76	3.2	81	3.3	83	4.8	83	3.5	80	5.4	74	3.6	64	3.8	57	4.3
Grand Junction, Colo. (AP)...	24	.6	32	.6	41	.9	52	7.6	62	7.7	71	4.7	78	8.7	76	1.2	67	1.0	54	8.3	.5	28	.7	
Grd. Rapids, Mich. (AP)...	24	1.9	24	1.7	33	2.4	45	2.9	56	3.3	67	3.2	72	2.6	70	2.6	62	3.5	50	2.6	38	2.5	27	2.2
Helena, Mont.	18	.6	23	.5	32	8.4	43	1.8	59	2.5	68	2.4	68	1.1	66	9.9	55	1.4	45	7.7	32	7.7	23	7.7
Honolulu, H.	72	4.3	72	2.5	72	2.3	73	2.0	75	1.0	77	.6	78	.9	78	1.1	78	1.3	77	2.3	75	2.1	73	3.5
Huron, S. D. (AP)....	13	.6	18	.5	32	1.1	46	1.9	58	2.2	68	3.1	75	2.1	73	2.5	63	1.7	50	1.3	32	.7	20	.4
Indianapolis, Ind. (AP)...	29	3.0	32	2.1	40	3.9	51	3.7	61	3.8	71	4.2	76	3.2	74	3.5	67	3.6	56	2.4	42	3.0	31	2.7
Jacksonville, Fla. (AP)...	57	2.8	59	2.6	63	3.5	69	3.0	75	3.6	80	6.7	82	7.9	81	6.3	79	6.8	71	6.1	63	1.6	58	2.4
Juneau, Alaska.....	36	4.5	37	3.3	33	3.4	40	2.9	47	3.2	54	3.2	55	4.6	54	5.2	49	6.9	42	8.5	33	5.9	27	4.2
Kansas City, Mo. (AP)...	30	1.4	35	1.2	44	2.5	56	3.6	65	4.4	75	5.0	81	2.8	79	3.9	71	3.8	60	2.9	44	2.2	34	1.5
Lander, Wyo. (AP)....	17	.5	23	.6	31	1.1	42	2.4	52	2.2	61	1.3	70	.9	68	.6	57	1.2	43	1.5	30	.9	20	.5
Little Rock, Ark. (AP)...	42	5.1	46	4.1	53	4.9	62	5.2	70	4.9	78	3.4	82	3.1	81	3.1	75	2.8	64	2.8	51	3.9	44	4.1
Los Angeles, Calif.....	55	2.4	56	3.4	59	2.4	61	1.2	65	3.6	68	1.7	73	1.7	73	1.7	71	3.0	7	5.6	1.0	57	3.1	
Louisville, Ky.....	36	4.1	38	3.0	45	4.7	56	4.1	65	3.8	75	4.0	79	3.1	77	3.3	71	2.7	60	2.5	47	3.1	38	3.3
Marquette, Mich.....	19	2.2	19	1.7	27	2.0	39	2.5	50	2.6	60	3.6	66	3.1	65	2.7	58	3.4	47	2.3	34	3.1	23	2.0
Memphis, Tenn.....	42	5.4	44	4.2	52	6.2	62	4.7	70	3.6	79	3.2	81	3.1	80	2.5	75	2.6	65	3.2	52	4.3	44	4.8
Miami, Fla.....	68	2.1	69	1.7	71	2.1	74	3.4	78	4.3	81	5.5	82	4.4	82	5.1	81	6.7	78	7.9	72	2.2	69	1.7
Midford, Utah (AP)....	24	.6	31	.7	39	1.1	48	8.5	57	7.6	66	4.7	74	.8	72	.8	63	4.5	50	.9	37	.5	28	.7
Milwaukee, Wis.....	23	1.7	25	1.4	34	2.4	45	2.6	55	2.9	65	3.2	72	2.4	71	2.9	64	3.4	53	2.1	38	2.3	27	1.6
Minneapolis, Minn. (AP)...	15	.8	18	.9	31	1.5	46	1.9	58	3.1	68	4.3	74	2.7	71	2.6	62	2.8	50	1.6	33	1.4	19	.8
Mobile, Ala.....	53	4.8	55	4.4	60	7.1	67	5.0	74	4.7	80	5.9	81	7.9	81	5.3	79	4.9	70	3.1	59	3.4	54	5.2
Nashville, Tenn. (AP)...	40	4.9	42	4.2	50	5.3	60	3.7	68	3.8	77	3.2	80	4.0	79	3.3	73	2.7	62	2.5	49	3.4	42	4.1
New Haven, Conn. (AP)...	29	3.9	29	3.3	37	4.1	46	3.9	57	3.9	66	3.8	71	3.7	70	4.1	64	3.5	53	3.0	43	3.9	32	3.9
New Orleans, La.....	56	4.8	58	4.2	63	6.7	70	5.4	76	5.4	82	5.6	83	7.1	83	6.4	80	5.8	73	3.7	62	4.0	57	4.6
New York City.....	33	3.6	33	3.3	41	3.7	51	3.4	62	3.8	71	3.7	76	4.2	74	4.6	68	4.0	58	3.0	47	3.2	36	3.2
Nome, Alaska (AP)....	6	1.2	6	.9	8	.9	21	.8	34	.6	46	1.1	50	2.5	49	.8	42	2.9	30	1.7	17	1.1	8	1.2
Norfolk, Va. (AP)....	42	3.2	42	3.1	49	3.3	56	3.2	66	3.4	73	4.2	78	6.0	76	5.1	72	3.9	61	2.4	51	2.7	43	2.9
North Platte, Neb. (AP)...	24	.4	29	.3	36	.9	49	2.1	59	2.1	69	2.9	76	2.4	74	2.4	71	1.7	52	1.0	37	.5	27	.4
Oklahoma City, Okla....	38	1.6	42	1.3	50	2.1	61	3.6	69	4.6	78	4.4	83	2.4	82	2.0	75	3.5	64	2.9	50	2.0	41	1.5
Omaha, Neb. (AP)....	23	.8	27	.9	38	1.3	52	2.1	63	2.7	73	4.5	78	3.3	76	3.1	67	3.2	55	1.7	39	1.3	27	.8

Stations	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.	T.	P.
Parkersburg, W. Va. . .	34	3.2	35	2.6	44	3.5	54	3.1	63	3.5	72	4.2	76	4.2	74	4.1	68	3.0	57	2.1	45	2.7	36	2.9
Philadelphia, Pa. (AP) . .	32	3.4	34	3.0	42	3.4	52	3.4	63	3.6	72	4.0	76	4.2	74	4.6	68	3.4	57	2.6	46	3.1	36	2.8
Phoenix, Ariz.	51	6	56	8	61	7	68	4	77	8.5	1	90	7	89	9	84	10	84	4	60	3	53	10	
Pittsburgh, Pa. (AP) . . .	29	2.8	30	3.3	39	3.4	49	3.1	60	3.5	69	3.8	72	3.7	70	3.1	65	2.8	53	2.5	41	6		
Portland, Me. (AP)	21	4.4	21	3.8	31	4.0	42	3.7	52	3.4	62	3.3	68	2.8	66	2.6	59	3.1	48	3.0	37	3.8		
Portland, Ore.	39	5.4	44	4.9	48	4.1	54	2.4	59	1.9	64	1.6	68	4	68	6	64	1.8	56	3.5	47	6.0		
Providence, R. I. (AP) . . .	29	3.7	29	2.8	37	3.6	46	3.4	57	3.0	66	3.2	71	3.1	69	3.6	63	3.2	53	2.8	43	3.7		
Pueblo, Colo. (AP)	29	4	34	5	40	7	50	1.2	59	1.7	69	1.4	75	1.8	73	1.8	65	7	53	7	39	5		
Raleigh, N. C. (AP)	41	3.2	43	3.5	50	3.6	59	3.5	67	3.6	76	4.3	79	5.6	77	5.1	73	4.6	61	2.7	50	2.7		
Rapid City, S. D. (AP) . .	21	5	24	3	31	1.1	44	2.0	55	3.0	64	3.4	72	2.1	71	1.6	60	1.2	49	1.1	35	5		
Reno, Nev. (AP)	31	1.0	36	1.0	41	7	48	5	55	5	61	4	70	2	67	2	60	2	51	5	40	6		
Richmond, Va.	40	3.6	41	2.7	48	3.4	57	3.3	66	3.7	75	3.8	78	5.4	76	4	71	3.4	60	2	50	2.4		
Roseburg, Ore. (AP)	40	4.6	43	3.8	47	2.0	52	2.1	57	1.7	62	1.3	67	2	67	3	62	1	54	2	46	4.5		
St. Louis, Mo. (AP)	32	1.9	36	1.7	44	3.4	56	3.9	65	4.0	75	4.4	80	2	78	3	70	3.5	59	3.1	45	2.0		
S. Lake City, Utah (AP) . .	27	1.2	34	1.3	42	1.7	51	1.8	60	1.6	67	1.0	77	6	74	9	64	7	53	1.3	39	1.4		
San Antonio, Tex (AP) . . .	51	1.8	56	1.6	61	2.1	69	3.0	76	3.5	82	3.2	84	1.9	84	2	79	3	47	2.1	60	1.4		
San Diego, Calif. (AP) . . .	55	1.7	56	2.3	58	1.5	60	8	63	3	66	1	69	1	70	1	69	2	65	6	61	8		
S. Francisco, Cal. (AP) . . .	48	4.0	51	4.0	53	2.8	54	1.5	57	6	60	1	60	0	61	0	62	1	59	1	54	2.3		
San Juan, Puerto Rico. . . .	75	4.7	75	2.7	76	2.4	77	3.8	79	6.5	79	5.2	80	6	80	6	80	6	80	5	78	6.4		
Sault Ste. Marie (AP)	14	2.2	13	1.5	23	1.8	37	1.9	49	2.5	58	3.0	64	2.5	63	2	55	3	5	4	3	3.3		
Savannah, Ga. (AP)	52	2.4	54	2.8	59	3.5	66	2.5	73	2.9	80	5.2	81	7	81	6	77	6	5	4	3	1.5		
Seattle, Wash. (AP)	41	4.5	43	3.7	47	3.1	52	1.9	57	1.6	62	1.2	66	5	65	9	61	1	54	3	47	4.5		
Sioux City Iowa (AP)	19	7	23	7	35	1.3	49	2.1	60	3.3	70	4.4	76	2	74	2	64	3	53	1	43	1.2		
Spokane, Wash. (AP)	25	1.7	30	1.5	38	1.3	46	1.0	55	1.0	61	1.2	70	4	68	5	59	9	49	1	36	1.9		
Springfield, Mo. (AP) . . .	33	2.3	37	1.8	45	3.2	55	4.3	64	5.0	73	5.7	77	3.2	76	4	69	3	58	3	44	2.7		
Syracuse, N. Y. (AP)	25	2.8	26	2.5	34	3.2	46	3.1	58	2.9	68	3.7	72	3.3	70	3	63	2	52	3	41	3.1		
Tampa, Fla. (AP)	61	2.0	63	2.5	66	3.1	71	2.5	76	3	80	7	82	8	82	8	80	6	73	3	67	1.0		
Trenton, N. J.	33	3.2	33	2.7	41	3.2	51	3.0	62	3.5	71	3.9	75	4.1	73	4	67	3	56	2	46	2.9		
Trenton, N. J.	33	3.2	33	2.7	41	3.2	51	3.0	62	3.5	71	3.9	75	4.1	73	4	67	3	56	2	46	2.9		
Vicksburg, Miss.	49	5.4	52	5.1	58	6.0	66	4.9	72	4.7	79	3.8	81	4	81	2	77	1	68	2	57	4.6		
Washington, D. C.	36	3.4	37	2.6	46	3.4	55	3.2	65	3.9	74	3.4	78	4	76	4	70	4	58	3	48	2.8		
Williston, N. D.	10	5	13	5	26	7	43	1.1	55	1.7	63	3	71	2	68	1	57	1	45	8	28	6		
Wilmington, Del. (AP) . . .	33	3.6	34	3.0	42	3.6	52	3.6	63	3.8	72	4.0	76	4	74	5	63	3	56	3	46	3.3		
Wilmington, N. C. (AP) . .	48	3.1	49	3.3	55	3.4	62	2.7	70	3.4	78	4.5	80	8	79	6	75	5	69	2	58	2.6		

1.27 HEATING

1 gal (U.S.) of water = 8.33 lb = 231 cu in. (at 39.2°F)
1 cu ft of water = 7.48 gal = 62.418 lb (at 39.2°F)

British thermal unit (Btu) = heat to raise 1 lb water through 1°F
Specific heat of water = 1 Btu
Specific heat of air = 0.24 Btu

1 cu ft of air (at 32°F) = 0.0807 lb
1 Btu will heat 1 cu ft of air 55°F

Air Flow

$$\text{Btu} = \frac{TC}{55}$$

$$DS = \frac{144C}{60V}$$

Btu = British thermal unit
T = temperature rise, degrees, Fahrenheit
C = cubic feet of air delivered per hour
DS = cross section of duct, inches
V = flow velocity, cubic feet per minute

Radiation

1 sq ft of steam radiation = 240 Btu
1 sq ft of hot water radiation = 150 Btu

1.28 TEMPERATURE CONVERSION

(Courtesy World Almanac 1962, New York World Telegram)

Source: Smithsonian Physical Tables

The numbers in **bold face type** refer to the temperature either in degrees Centigrade or Fahrenheit which are to be converted. If converting from degrees Fahrenheit to Centigrade, the equivalent will be found in the column on the left, while if converting from degrees Centigrade to Fahrenheit the answer will be found in the column on the right.

For temperatures not shown. To convert Fahrenheit to Centigrade subtract 32 degrees and multiply by 5, divide by 9; to convert Centigrade to Fahrenheit, multiply by 9, divide by 5 and add 32 degrees.

Centi- grade	Fahren- heit	Centi- grade	Fahren- heit	Centi- grade	Fahren- heit
-273.2	-459.7	-	0	32	95
-184	-300	-17.8	10	50	98
-169	-273	-12.2	20	68	100
-157	-250	-6.67	30	86	110
-129	-200	-	40	104	120
-101	-150	1.11	50	122	130
-73.3	-100	4.44	60	140	140
-45.6	-50	10.0	70	158	150
-40.0	-40	15.0	80	176	160
-34.4	-30	21.1	90	194	170
-28.9	-20	23.9	100	212	180
-23.3	-10	26.7	110	230	190
		29.4	120	248	200
		32.2	130	266	210
			140	284	220
			150	302	230
			160	320	240
			170	338	250
			180	356	260
			190	374	270
			200	392	280
			210	410	290
			220	428	300
			230	446	310
			240	464	320
			250	482	330
			260	500	340
			270	518	350
			280	536	360
			290	554	370
			300	572	380

Water boils at 212° Fahrenheit at sea level. Alcohol boils at 167° Fahrenheit. Tallow melts at 137° Fahrenheit. Blood heat, 98.6° Fahrenheit. Water freezes at 32° Fahrenheit.

1.29 AVERAGE RISE AND FALL OF TIDE

Courtesy World Almanac 1962, New York World-Telegram

Places	Feet	In.
Balboa, Panama	12	7
Baltimore, Md.	1	1
Boston, Mass.	9	6
Charleston, S. C.	5	1
Colon, Panama	1	1
Eastport, Me.	18	2
Galveston, Tex.	1	0
Key West, Fla.	1	4
Mobile, Ala.	1	6
New London, Conn.	2	7
New Orleans, La.	See Note	
Newport, R. I.	3	6
New York, N. Y.	4	5
Old Pt. Comfort, Va.	2	6
Philadelphia, Pa.	5	11
Portland, Me.	8	11
San Diego, Calif.	4	2
Sandy Hook, N. J.	4	7
San Francisco, Calif.	4	0
Savannah, Ga.	7	5
Seattle, Wash.	7	7
Tampa, Fla.	1	10
Washington, D. C.	2	11

At New Orleans, the periodic rise and fall of the tide varies with the stage of the Mississippi River, being about 10 inches at low river stage and zero at high river stage.

The Canadian Tide Tables for 1961 give a maximum range of nearly 50 feet at Leaf Basin, Ungava Bay, Canada.

Huge tides occur in the Bay of Fundy, between Nova Scotia and New Brunswick, where, under a combination of certain astronomical conditions, it is possible for the tide in Minas Basin to rise $53\frac{1}{2}$ feet from low water. The mean range at Calais, Maine, is 20 feet but a range in excess of 23 feet can be expected each month.

SECTION II

Earthwork

2.1 BEARING CAPACITY OF SOILS

This table is approximate only. The actual bearing capacity of soils depends on the composition, the moisture content, and the extent of the strata. Local building codes usually give the allowable bearing capacity of soils.

Material	Bearing value	
	Tons per sq ft	Lb per sq ft
Clay, soft	1	2,000
Clay, hard	6	12,000
Clay, medium	4	8,000
Sand and clay mixed	2	4,000
Sand, fine, loose	1	2,000
Sand, coarse, loose	3	6,000
Sand (dry), fine, compact	3	6,000
Sand (dry), coarse, compact	4	8,000
Sand and gravel mixed (loose)	4	8,000
Sand and gravel mixed (compact)	5	10,000
Gravel, compact	6	12,000
Rock, soft	8	16,000
Rock, medium	15	30,000
Rock, hard	35	70,000
Hardpan	10	20,000
Shale, in sound condition	10	20,000

2.2 TRENCH EXCAVATION VOLUME

Width, ft.-in.

Depth, ft.-in.	Cubic yards per 100 lineal feet											
	1-0	2-0	3-0	4-0	5-0	6-0	7-0	8-0	9-0	10-0	11-0	12-0
1-0	3.7	7.4	11.1	14.8	18.5	22.2	25.9	29.6	33.3	37.0	40.7	44.4
1-6	5.6	11.1	16.7	22.2	27.8	33.3	38.9	44.4	50.0	55.6	61.1	66.7
2-0	7.4	14.8	22.2	29.6	37.0	44.4	51.9	59.3	66.7	74.1	81.5	88.9
2-6	9.3	18.5	27.8	37.0	46.3	55.6	64.8	74.1	83.3	92.6	101.9	111.1
3-0	11.1	22.2	33.3	44.4	55.6	66.7	77.8	88.9	100.0	111.1	122.2	133.3
3-6	13.0	25.9	38.9	51.9	64.8	77.8	90.7	103.7	116.7	129.6	142.6	155.6
4-0	14.8	29.6	44.4	59.3	74.1	88.9	103.7	118.5	133.3	148.2	163.0	177.8
4-6	16.7	33.3	50.0	66.7	83.3	100.0	116.7	133.3	150.0	166.7	183.3	200.0
5-0	18.5	37.0	55.6	74.1	92.6	111.1	129.6	148.2	166.7	185.2	203.7	222.2
5-6	20.4	40.7	61.1	81.5	101.9	122.2	142.6	163.0	183.3	203.7	224.1	244.5
6-0	22.2	44.4	66.7	88.9	111.1	133.3	155.6	177.8	200.0	222.2	244.5	266.7
6-6	24.1	48.1	72.2	96.3	120.4	144.5	168.5	192.6	216.7	240.7	264.8	288.9
7-0	25.9	51.9	77.8	103.7	129.6	155.6	181.5	207.4	233.4	259.3	285.2	311.1
7-6	27.8	55.6	83.3	111.1	138.9	166.7	194.5	222.2	250.0	277.8	305.6	333.4
8-0	29.6	59.3	88.9	118.5	148.2	177.8	207.4	237.1	266.7	296.3	326.0	355.6
8-6	31.5	63.0	94.5	125.9	157.4	188.9	220.4	251.9	283.4	314.8	346.3	377.8
9-0	33.3	66.7	100.0	133.3	166.7	200.0	233.4	266.7	300.0	333.4	366.7	400.0
9-6	35.2	70.4	105.6	140.8	176.0	211.1	246.3	281.5	316.7	351.9	387.1	422.3
10-0	37.0	74.1	111.1	148.2	185.2	222.2	259.3	296.3	333.4	370.4	407.4	444.5
10-6	38.9	77.8	116.7	155.6	194.5	233.4	272.2	311.1	350.0	388.9	427.8	466.7
11-0	40.7	81.5	122.2	163.0	203.7	244.5	285.2	326.0	366.7	407.4	448.2	488.9
11-6	42.6	85.2	127.8	170.4	213.0	255.6	298.2	340.8	383.4	426.0	468.6	511.1
12-0	44.4	88.9	133.3	177.8	222.2	266.7	311.1	355.6	400.0	444.5	488.9	533.4

2.3 GRADING CUT OR FILL

(Using 1-in. grids)

Scale, Cut or fill,
in. = ft sq ft per 1-in. block

$\frac{1}{16} = 1$	256
$\frac{1}{8} = 1$	1,024
1 = 10	100
1 = 20	400
1 = 30	900
1 = 40	1,600
1 = 50	2,500
1 = 60	3,600
1 = 100	10,000

Depth, ft.-in.	Square feet per block								
	256	1,024	100	400	900	1,600	2,500	3,600	10,000
	Scale, in. = ft								
	$\frac{1}{16} = 1$	$\frac{1}{8} = 1$	1 = 10	1 = 20	1 = 30	1 = 40	1 = 50	1 = 60	1 = 100
Cut or fill per 1-in. \times 1-in. block, cu ft									
0-3	64	256	25	100	225	400	625	900	2,500
0-6	128	512	50	200	450	800	1,250	1,800	5,000
0-9	192	768	75	300	675	1,200	1,875	2,700	7,500
1-0	256	1,024	100	400	900	1,600	2,500	3,600	10,000
1-3	320	1,280	125	500	1,125	2,000	3,125	4,500	12,500
1-6	384	1,536	150	600	1,350	2,400	3,750	5,400	15,000
1-9	448	1,792	175	700	1,575	2,800	4,375	6,300	17,500
2-0	512	2,048	200	800	1,800	3,200	5,000	7,200	20,000
2-3	576	2,304	225	900	2,025	3,600	5,625	8,100	22,500
2-6	640	2,560	250	1,000	2,250	4,000	6,250	9,000	25,000
2-9	704	2,816	275	1,100	2,475	4,400	6,875	9,900	27,500
3-0	768	3,072	300	1,200	2,700	4,800	7,500	10,800	30,000
3-3	832	3,328	325	1,300	2,925	5,200	8,125	11,700	32,500
3-6	896	3,584	350	1,400	3,150	5,600	8,750	12,600	35,000
3-9	960	3,840	375	1,500	3,375	6,000	9,375	13,500	37,500
4-0	1,024	4,096	400	1,600	3,600	6,400	10,000	14,400	40,000
4-3	1,088	4,352	425	1,700	3,825	6,800	10,625	15,300	42,500
4-6	1,152	4,608	450	1,800	4,050	7,200	11,250	16,200	45,000
4-9	1,216	4,864	475	1,900	4,275	7,600	11,875	17,100	47,500

2.3 GRADING CUT OR FILL (Cont.)

Depth, ft.-in.	Square feet per block								
	256	1,024	100	400	900	1,600	2,500	3,600	10,000
	Scale, in. = ft								
	$\frac{1}{16} = 1$	$\frac{1}{8} = 1$	1 = 10	1 = 20	1 = 30	1 = 40	1 = 50	1 = 60	1 = 100
Cut or fill per 1-in. x 1-in. block, cu ft									
5-0	1,280	5,120	500	2,000	4,500	8,000	12,500	18,000	50,000
5-3	1,344	5,376	525	2,100	4,725	8,400	13,125	18,900	52,500
5-6	1,408	5,632	550	2,200	4,950	8,800	13,750	19,800	55,000
5-9	1,472	5,888	575	2,300	5,175	9,200	14,375	20,700	57,500
6-0	1,536	6,144	600	2,400	5,400	9,600	15,000	21,600	60,000
6-3	1,600	6,400	625	2,500	5,625	10,000	15,625	22,500	62,500
6-6	1,664	6,656	650	2,600	5,850	10,400	16,250	23,400	65,000
6-9	1,728	6,912	675	2,700	6,075	10,800	16,875	24,300	67,500
7-0	1,792	7,168	700	2,800	6,300	11,200	17,500	25,200	70,000
7-3	1,856	7,424	725	2,900	6,525	11,600	18,125	26,100	72,500
7-6	1,920	7,680	750	3,000	6,750	12,000	18,750	27,000	75,000
7-9	1,984	7,936	775	3,100	6,975	12,400	19,375	27,900	77,500
8-0	2,048	8,192	800	3,200	7,200	12,800	20,000	28,800	80,000
8-3	2,112	8,448	825	3,300	7,425	13,200	20,625	29,700	82,500
8-6	2,176	8,704	850	3,400	7,650	13,600	21,250	30,600	85,000
8-9	2,240	8,960	875	3,500	7,875	14,000	21,875	31,500	87,500
9-0	2,304	9,216	900	3,600	8,100	14,400	22,500	32,400	90,000
9-3	2,368	9,472	925	3,700	8,325	14,800	23,125	33,300	92,500
9-6	2,432	9,728	950	3,800	8,550	15,200	23,750	34,200	95,000
9-9	2,496	9,984	975	3,900	8,775	15,600	24,375	35,100	97,500
10-0	2,560	10,240	1,000	4,000	9,000	16,000	25,000	36,000	100,000
10-3	2,624	10,496	1,025	4,100	9,225	16,400	25,625	36,900	102,500
10-6	2,688	10,752	1,050	4,200	9,450	16,800	26,250	37,800	105,000
10-9	2,752	11,008	1,075	4,300	9,675	17,200	26,875	38,700	107,500
11-0	2,816	11,264	1,100	4,400	9,900	17,600	27,500	39,600	110,000
11-3	2,880	11,520	1,125	4,500	10,125	18,000	28,125	40,500	112,500
11-6	2,944	11,776	1,150	4,600	10,350	18,400	28,750	41,400	115,000
11-9	3,008	12,032	1,175	4,700	10,575	18,800	29,375	42,300	117,500
12-0	3,072	12,288	1,200	4,800	10,800	19,200	30,000	43,200	120,000
12-3	3,136	12,544	1,225	4,900	11,025	19,600	30,625	44,100	122,500
12-6	3,200	12,800	1,250	5,000	11,250	20,000	31,250	45,000	125,000
12-9	3,264	13,056	1,275	5,100	11,475	20,400	31,875	45,900	127,500

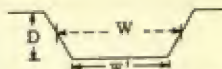
2.3 GRADING CUT OR FILL (Cont.)

Depth, ft.-in.	Square feet per block								
	256	1,024	100	400	900	1,600	2,500	3,600	10,000
	Scale, in. = ft								
	$\frac{1}{16} = 1$	$\frac{1}{8} = 1$	1 = 10	1 = 20	1 = 30	1 = 40	1 = 50	1 = 60	1 = 100
	Cut or fill per 1-in. \times 1-in. block, cu ft								
13-0	3,328	13,312	1,300	5,200	11,700	20,800	32,500	46,800	130,000
13-3	3,392	13,568	1,325	5,300	11,925	21,200	33,125	47,700	132,500
13-6	3,456	13,824	1,350	5,400	12,150	21,600	33,750	48,600	135,000
13-9	3,520	14,080	1,375	5,500	12,375	22,000	34,375	49,500	137,500
14-0	3,584	14,336	1,400	5,600	12,600	22,400	35,000	50,400	140,000
14-3	3,648	14,592	1,425	5,700	12,825	22,800	35,625	51,300	142,500
14-6	3,712	14,848	1,450	5,800	13,050	23,200	36,250	52,200	145,000
14-9	3,776	15,104	1,475	5,900	13,275	23,600	36,875	53,100	147,500
15-0	3,840	15,360	1,500	6,000	13,500	24,000	37,500	54,000	150,000
15-3	3,904	15,616	1,525	6,100	13,725	24,400	38,125	54,900	152,500
15-6	3,968	15,872	1,550	6,200	13,950	24,800	38,750	55,800	155,000
15-9	4,032	16,128	1,575	6,300	14,175	25,200	39,375	56,700	157,500
16-0	4,096	16,384	1,600	6,400	14,400	25,600	40,000	57,600	160,000

2.4 SLOPE OF BANKS IN TRENCHES

W = width (average)
D = depth
w' = width at bottom

$$\frac{\text{Hor}}{\text{Vert}} D + w' = W$$



Slope (horiz. to vert.) :	Width, avg (width to figure for excavation)	Example
1:1	$D + w'$	Trench 6' deep, 2' wide at bottom W = 8'
1:1½	$\frac{5}{3}D + w'$	12' cut for building, W = 64' × 59' 50' × 45' + 3' at bottom
1:2	$\frac{5}{2}D + w'$	Trench 8' deep, 3' wide at bottom W = 7'
1:2½	$\frac{7}{3}D + w'$	Trench 9' 2" deep, 3' 6" wide at bottom W = 7' 2"
1:3	$\frac{4}{3}D + w'$	Trench 10' deep, 3' wide at bottom W = 6' 4"
1:3½	$\frac{8}{3}D + w'$	10' 6" cut for building, W = 90' × 72' 80' × 62' + 3' 6" at bottom
1:4	$\frac{5}{4}D + w'$	Trench 5' deep, 3' 3" wide at bottom W = 4' 6"
1:4½	$\frac{10}{3}D + w'$	Trench 11' deep, 4' wide at bottom W = 6' 6"
1:5	$\frac{6}{5}D + w'$	Trench 11' deep, 4' wide at bottom W = 6' 3"
1:6	$\frac{7}{6}D + w'$	Trench 11' deep, 4' wide at bottom W = 6'

For bulk excavation such as for buildings, W will represent both width and length (as in the example shown for the 1:1½ slope). In these cases, the width at the bottom is the building dimension plus twice the working space at the bottom. For the example (1:1½ slope) the calculation is:

$$(\frac{5}{3} \times 12') + 50' + (2 \times 3') = 8' + 56' = 64'$$

$$(\frac{5}{3} \times 12') + 45' + (2 \times 3') = 8' + 51' = 59'$$

$$\text{Excavation} = 64' \times 59' \times 12'$$

SECTION III

Concrete

SECTION III

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THE HISTORY OF THE UNITED STATES

THE CONSTITUTION OF THE UNITED STATES

THE HISTORY OF THE UNITED STATES

3.1 FORMWORK FOR FOUNDATION WALLS

These tables are based on using 2 in. × 4 in. studs and double 2 in. × 4 in. walers with concrete mechanically vibrated; snap ties hold 3,000 lb.

Material	Stud spacing, in.	Waler spacing, ft-in.	Horizontal tie spacing, ft-in.	Rate of pour, ft per hr	Pouring temperature, deg F
$\frac{1}{2}$ " plyform	17	3- 0	3- 0	1	70
	14	3- 0	3- 0	2	70
	12	2- 8	2- 4	3	70
	14	2-10	3- 0	1	50
	12	2- 8	2- 4	2	50
$\frac{3}{8}$ " plyform	20	3- 0	3- 6	1	70
	16	2- 9	2-10	2	70
	14½	2- 6	2- 6	3	70
	14	2- 5	2- 0	4	70
	13	2- 3	1-10	5	70
	17	3- 0	3- 0	1	50
	14	2- 6	2- 4	2	50
	13	2- 3	1-10	3	50
	12	2- 1	1- 8	4	50
$\frac{3}{4}$ " plyform	24	3- 0	3- 6	1	70
	19	2- 9	2-11	2	70
	17	2- 3	2- 8	3	70
	16	2- 2	2- 6	4	70
	14½	2- 2	2- 1	5	70
	20	2- 9	3- 3	1	50
	16½	2- 4	2- 6	2	50
	15	2- 1	2- 1	3	50
	14	2- 0	1- 9	4	50
	13	1-10	1- 8	5	50
$\frac{3}{4}$ " sheathing	22	2- 6	3- 0	2	70
	18	2- 4	2- 8	3	70
	17	2- 2	2- 3	4	70
	16	2- 0	2- 2	5	70
	18	2- 4	2- 8	2	50
	16	2- 1	2- 3	3	50
	14½	2- 0	1-10	4	50
	13½	1-11	1- 7	5	50

3.2 WEIGHTS OF AGGREGATES AND CONCRETE

Type of aggregate	Aggregate weight per cu ft, lb	Weight per cu ft of concrete using aggregate, lb
Gravel	120	150
Sand	90-100	150
Crushed stone	100	145
Crushed bank slag	80	110-130
Haydite (expanded clay, shale)	40-60	100-120
Foamed slag	40-60	90-100
Cinders	40-50 (plus sand)	110-115
Pumice	30-60	60-90
Diatomite	28-40	55-70
Perlite	6-16	40-65
Vermiculite	6-10	25-50

From HHFA Survey, "Lightweight Aggregates for Concrete,"

3.3 CONCRETE MATERIALS PER CUBIC YARD

Proportions (cem.:sand: stone)	$\frac{3}{4}$ " max. coarse aggregate			1" max. coarse aggregate			$2\frac{1}{2}$ " coarse aggregate			Mixing water per cu yd, gal
	Cement, bags	Sand, cu yd	Stone, cu yd	Cement, bags	Sand, cu yd	Stone, cu yd	Cement, bags	Sand, cu yd	Stone, cu yd	
1:1 :2	9.2	0.36	0.74	10.3	0.39	0.78	10.5	0.40	0.80	38
1:1½ :3	6.9	0.40	0.80	7.4	0.42	0.84	7.6	0.44	0.88	36
1:2 :3	6.2	0.48	0.74	6.8	0.53	0.80	6.9	0.54	0.80	34
1:2 :4	5.4	0.42	0.82	5.9	0.45	0.89	6.0	0.46	0.80	33
1:2½ :4	5.0	0.47	0.75	5.4	0.53	0.83	5.5	0.54	0.85	34
1:2½ :5	4.5	0.42	0.84	4.8	0.47	0.92	4.9	0.47	0.93	32½
1:3 :4	4.6	0.53	0.73	5.1	0.59	0.78	5.2	0.58	0.79	32
1:3 :5	4.2	0.47	0.78	4.5	0.52	0.86	4.6	0.53	0.87	32½
1:3 :6	4.0	0.43	0.85	4.1	0.47	0.92	4.1	0.48	0.94	33

The quantities in the table assume damp sand with a moisture content of not over 5 per cent by volume. The quantity of sand in any mix must be increased by the amount its moisture content exceeds 5 per cent, and the mixing water must be proportionately decreased. The gradations of the coarse aggregate will affect the amount of sand in a mix; for example, if there are no "fines-to-dust" in the coarse aggregate, a slight increase in the volume of both the sand and coarse aggregate is necessary.

3.4 CONCRETE PROPORTIONS

The following is a rule of thumb—using coarse aggregate 2 in. to 2½ in. maximum.

To ascertain the approximate quantities of the ingredients per cubic yard of concrete use the following rule:

42 cu ft of material (plus mixing water) produces 1 cu yd of concrete; the cement content is the sum of the mix ratio figures divided into 42.

Example 1 A 1:2:4 mix has a total of 7 parts; 42 divided by 7 gives 6 bags of cement; therefore the volume of sand is 12 cu ft, and the volume of coarse aggregate is 24 cu ft.

Example 2 A 1:3:5 mix has 9 parts; 42 divided by 9 gives 4.7 bags of cement; there are 14 cu ft of sand and 23.3 cu ft of coarse aggregate.

3.5 WATER FOR CONCRETE

Proportions (cement:sand:stone)	Total water required per bag, gal*		Total water required per cubic yard, gal*	
	Minimum	Maximum	Minimum	Maximum
1:1½:3	5½	6	42	46
1:2 :3	5¾	6¼	40	43½
1:2 :4	6	6½	38	39
1:2½:5	7¼	7¾	36	38½
1:3 :6	8¼	8¾	35	37

Courtesy of A.C. Horn Co.

*Including the moisture in the sand.

Moisture in aggregates:

Very wet sand	Up to 1 gal per cu ft
Medium wet sand	Up to ¾ gal per cu ft
Damp sand	Up to ½ gal per cu ft
Damp gravel	Up to ¼ gal per cu ft

3.6 CONCRETE PROPORTIONS
(A) Materials for 100 sq ft of Concrete Slab,
Using Coarse Aggregate, 1 in. Maximum

Proportions (cem:sand:stone)	Slab thickness, in.	Cement, sacks	Sand, cu yd	Stone, cu yd
1:1 $\frac{3}{4}$:2 $\frac{1}{4}$	2 $\frac{1}{2}$	5.7	0.36	0.62
	3	6.8	0.43	0.74
	3 $\frac{1}{2}$	8.0	0.51	0.86
	4	9.1	0.58	0.99
	4 $\frac{1}{2}$	10.3	0.65	1.11
	5	11.4	0.73	1.23
	5 $\frac{1}{2}$	12.6	0.80	1.36
	6	13.7	0.87	1.48
1:2:3	2 $\frac{1}{2}$	5.2	0.40	0.59
	3	6.3	0.48	0.71
	3 $\frac{1}{2}$	7.3	0.56	0.83
	4	8.4	0.64	0.95
	4 $\frac{1}{2}$	9.4	0.72	1.06
	5	10.5	0.80	1.19
	5 $\frac{1}{2}$	11.6	0.88	1.31
	6	12.6	0.96	1.42
1:2:3 $\frac{1}{2}$	2 $\frac{1}{2}$	4.8	0.37	0.64
	3	5.8	0.44	0.76
	3 $\frac{1}{2}$	6.8	0.52	0.90
	4	7.7	0.59	1.02
	4 $\frac{1}{2}$	8.7	0.66	1.15
	5	9.7	0.74	1.28
	5 $\frac{1}{2}$	10.7	0.82	1.41
	6	11.6	0.89	1.54
1:2 $\frac{1}{2}$:4	2 $\frac{1}{2}$	4.2	0.40	0.63
	3	5.0	0.48	0.75
	3 $\frac{1}{2}$	5.8	0.56	0.88
	4	6.6	0.64	1.01
	4 $\frac{1}{2}$	7.5	0.72	1.13
	5	8.3	0.80	1.26
	5 $\frac{1}{2}$	9.2	0.88	1.39
	6	10.0	0.96	1.52
1:3:5	2 $\frac{1}{2}$	3.4	0.39	0.65
	3	4.1	0.47	0.78
	3 $\frac{1}{2}$	4.8	0.55	0.92
	4	5.5	0.63	1.05
	4 $\frac{1}{2}$	6.1	0.70	1.17
	5	6.8	0.79	1.31
	5 $\frac{1}{2}$	7.5	0.87	1.45
	6	8.2	0.94	1.57

3.6 CONCRETE PROPORTIONS (Cont.)
(B) Materials for 100 sq ft of Concrete Slab,
Using Coarse Aggregate, 2½ in. Maximum

Proportions (cem:sand:stone)	Slab thickness, in.	Cement, sacks	Sand, cu yd	Stone, cu yd
1:2:3	2½	5.5	0.42	0.63
	3	6.5	0.50	0.75
	3½	7.6	0.58	0.86
	4	8.7	0.65	0.97
	4½	9.8	0.75	1.13
	5	11.0	0.85	1.25
	5½	12.1	0.92	1.35
	6	13.1	0.97	1.45
1:2½:3	2½	5.1	0.50	0.58
	3	6.1	0.60	0.70
	3½	7.1	0.68	0.80
	4	8.1	0.75	0.90
	4½	9.2	0.90	1.05
	5	10.2	1.00	1.15
	5½	11.2	1.08	1.25
	6	12.2	1.15	1.35
1:2½:3½	2½	4.7	0.43	0.62
	3	5.6	0.51	0.72
	3½	6.5	0.60	0.86
	4	7.4	0.70	0.96
	4½	8.4	0.76	1.08
	5	9.2	0.85	1.20
	5½	10.2	0.95	1.35
	6	11.1	1.05	1.50
1:2½:4	2½	4.4	0.42	0.67
	3	5.3	0.50	0.80
	3½	6.2	0.58	0.93
	4	7.0	0.65	1.05
	4½	8.1	0.75	1.18
	5	8.8	0.84	1.35
	5½	9.7	0.91	1.48
	6	10.5	0.97	1.60
1:3:5	2½	3.6	0.41	0.68
	3	4.4	0.50	0.81
	3½	5.0	0.58	0.95
	4	5.7	0.64	1.10
	4½	6.6	0.75	1.25
	5	7.2	0.85	1.40
	5½	8.0	0.93	1.50
	6	9.0	1.00	1.56

3.7 CONCRETE MIXED IN JOB MIXERS

Proportions (cem.:sand:stone)	Mixer size, bags	Cement, bags	Sand, cu ft	Stone, cu ft
1:1½:3	1	1	1½	3
	2	2	3	6
	4	4	6	12
	6	6	9	18
	9	9	13½	27
1:2:3	1	1	2	3
	2	1½	3	4½
	4	4	8	12
	6	5½	11	16½
	9	8	16	24
1:2:3½	1	1	2	3½
	2	1½	3	5½
	4	3½	7	12½
	6	5	10	17½
	9	7½	15	26½
1:2:4	1	1	2	4
	2	1½	3	6
	4	3	6	12
	6	4½	9	18
	9	7	14	26
1:2½:4	1	1	2½	4
	2	1	2½	4
	4	3	7½	12
	6	4½	11½	18
	9	6	15	24
1:2½:4½	1	1	2½	4½
	2	1	2½	4½
	4	2½	6½	11½
	6	4	10	18
	9	6	15	26
1:2:5	1	½	1	2½
	2	1	2	5
	4	2½	5	12½
	6	4	8	20
	9	6	12	30

3.7 CONCRETE MIXED IN JOB MIXERS (Cont.)

Proportions (cem.:sand:stone)	Mixer size, bags	Cement, bags	Sand, cu ft	Stone, cu ft
1:2½:5	1	½	1½	2½
	2	1	2½	5
	4	2½	6½	12½
	6	4	10	20
	9	5½	13½	27½
1:3:5	1	½	1½	2½
	2	1	3	5
	4	2½	7½	12½
	6	3½	10½	17½
	9	5	15	25
1:3:6	1	½	1½	3
	2	1	3	6
	4	2	6	12
	6	3	9	18
	9	4½	13½	27
1:4:8	1	½	2	4
	2	1	2	4
	4	1½	6	12
	6	2½	10	20
	9	3½	14	28

Proportions (cem.:gravel)	Mixer size, bags	Cement, bags	Gravel, cu ft
1:5	1	1	5
	2	1	5
	4	2½	12½
	6	3½	17½
	9	5	25
1:6	1	½	3
	2	1	6
	4	2½	15
	6	3½	21
	9	5	30

3.8 LIGHTWEIGHT CONCRETE

Vermiculite Concrete
(Materials per Cubic Yard of Concrete)

Proportion (cement:vermiculite)	Cement, bags	Vermiculite, cu ft	Water, gal	Density, lb per cu ft	Compressive strength, psi	Thermal K
1:3	10.0	30	90	38	380	1.10
1:4	7.5	30	90	30	240	0.80
1:5	6.0	30	90	27	150	0.70
1:6	5.0	30	90	24	115	0.65
1:7	4.3	30	90	23	95	0.62
1:8	3.75	30	90	22	70	0.60

All quantities are approximate; yield varies according to materials and mixing.

Perlite Concrete
(Materials per Cubic Yard of Concrete)

Proportion (cement:perlite)	Cement, bags	Perlite, cu ft	Water, gal	Density, lb per cu ft	Compression strength, psi
1:4	6.75	27	61	50.5	440
1:5	5.40	27	59½	45.5	270
1:6	4.50	27	54	40.5	180
1:7	3.85	27	54	38.0	130
1:8	3.38	27	54	36.5	95

All quantities are approximate; yield varies according to materials and mixing. For air entraining, add 6.75 pints of air entraining admix per cubic yard to all mixes.

3.9 CONCRETE YIELD FOR WALLS AND SLABS

One cubic yard of concrete is equivalent to:

Thickness, in.	Area, sq ft	Thickness, in.	Area, sq ft	Thickness, in.	Area, sq ft
1	324	5	65	9	36
1 $\frac{1}{2}$	259	5 $\frac{1}{2}$	62	9 $\frac{1}{2}$	35
1 $\frac{3}{4}$	216	5 $\frac{3}{4}$	59	9 $\frac{3}{4}$	34
1 $\frac{1}{4}$	185	5 $\frac{1}{4}$	56	9 $\frac{1}{4}$	33
2	162	6	54	10	32.5
2 $\frac{1}{2}$	144	6 $\frac{1}{2}$	52	10 $\frac{1}{2}$	31.5
2 $\frac{3}{4}$	130	6 $\frac{3}{4}$	50	10 $\frac{3}{4}$	31
2 $\frac{1}{4}$	118	6 $\frac{1}{4}$	48	10 $\frac{1}{4}$	30
3	108	7	46	11	29.5
3 $\frac{1}{2}$	100	7 $\frac{1}{2}$	45	11 $\frac{1}{2}$	29
3 $\frac{3}{4}$	93	7 $\frac{3}{4}$	43	11 $\frac{3}{4}$	28
3 $\frac{1}{4}$	86	7 $\frac{1}{4}$	42	11 $\frac{1}{4}$	27.5
4	81	8	40	12	27
4 $\frac{1}{2}$	76	8 $\frac{1}{2}$	39	15	21.5
4 $\frac{3}{4}$	72	8 $\frac{3}{4}$	38	16	18
4 $\frac{1}{4}$	68	8 $\frac{1}{4}$	37	24	13.5

3.10 CONCRETE FOR CONTINUOUS WALL FOOTINGS

Width, in.	Depth						
	6 in.	8 in.	10 in.	11 in.	12 in.	14 in.	15 in.
	Cubic feet per 100 lineal feet						
8	33	44	55				
9	38	50	62				
10	42	56	69				
11	46	61	76	84			
12	50	67	83	92	100		
13	54	72	90	99	108		
14	58	78	97	107	117	136	
15	63	83	104	115	125	146	156
16	67	89	111	122	133	156	167
17	71	94	118	130	142	165	177
18	75	100	125	138	150	175	188
19	79	105	132	145	158	185	198
20	83	111	139	153	167	194	208
21	88	117	146	160	175	204	219
22	92	122	153	168	183	214	229
23	96	128	160	176	192	224	240
24	100	133	167	183	200	233	250
25	104	139	174	191	208	243	260
26	108	144	181	199	217	253	271
27	113	150	187	206	225	263	281
28	117	155	194	214	233	272	292
29	121	161	201	222	242	282	302
30	125	167	208	229	250	292	313
31	129	172	215	237	258	301	323
32	133	178	222	244	267	311	333
33	138	183	229	252	275	321	344
34	142	189	236	260	283	331	354
35	146	194	243	267	292	340	365
36	150	200	250	275	300	350	375

3.10 CONCRETE FOR CONTINUOUS WALL FOOTINGS (Cont.)

Width, in.	Depth						
	16 in.	18 in.	20 in.	22 in.	24 in.	26 in.	27 in.
	Cubic feet per 100 lineal feet						
16	178						
17	189	213					
18	200	225					
19	211	238					
20	222	250	278				
21	233	263	292				
22	244	275	306	336			
23	256	288	319	351			
24	267	300	333	367	400		
25	278	313	347	382	417		
26	289	325	361	397	433	469	
27	300	338	375	413	450	488	506
28	311	350	389	428	467	506	525
29	322	363	403	443	483	524	544
30	333	375	417	458	500	542	563
31	344	388	431	474	517	560	581
32	356	400	444	489	533	578	600
33	367	413	458	504	550	596	619
34	378	425	472	519	567	614	638
35	389	438	486	535	583	632	656
36	400	450	500	550	600	650	675
37	411	463	514	565	617	668	694
38	422	475	528	581	633	686	713
39	433	488	542	596	650	704	731
40	444	500	556	611	667	722	750
41	456	513	569	626	683	740	769
42	467	525	583	642	700	758	788
43	478	538	597	657	717	776	806
44	489	550	611	672	733	794	825
45	500	563	625	688	750	813	844

3.11 CONCRETE FOR WALLS (PER 100 LIN FT OF WALL)

Height, ft-in.	Thickness					Forms, sq ft
	6 in.	8 in.	9 in.	10 in.	12 in.	
	Concrete, cu ft					
1-0	50	67	75	83	100	200
1-6	75	100	113	125	150	300
2-0	100	133	150	167	200	400
2-6	125	167	188	208	250	500
3-0	150	200	225	250	300	600
3-6	175	233	263	292	350	700
4-0	200	267	300	333	400	800
4-6	225	300	338	375	450	900
5-0	250	333	375	417	500	1,000
5-6	275	367	413	458	550	1,100
6-0	300	400	450	500	600	1,200
6-6	325	433	488	542	650	1,300
7-0	350	467	525	583	700	1,400
7-6	375	500	563	625	750	1,500
8-0	400	533	600	667	800	1,600
8-6	425	567	638	708	850	1,700
9-0	450	600	675	750	900	1,800
9-6	475	633	713	792	950	1,900
10-0	500	667	750	833	1,000	2,000
10-6	525	700	788	875	1,050	2,100
11-0	550	733	825	917	1,100	2,200
11-6	575	767	863	958	1,150	2,300
12-0	600	800	900	1,000	1,200	2,400
12-6	625	833	938	1,042	1,250	2,500
13-0	650	867	975	1,083	1,300	2,600
13-6	675	900	1,013	1,125	1,350	2,700
14-0	700	933	1,050	1,167	1,400	2,800
14-6	725	967	1,088	1,208	1,450	2,900
15-0	750	1,000	1,125	1,250	1,500	3,000
15-6	775	1,033	1,163	1,292	1,550	3,100
16-0	800	1,067	1,200	1,333	1,600	3,200
16-6	825	1,100	1,238	1,375	1,650	3,300
17-0	850	1,133	1,275	1,417	1,700	3,400
17-6	875	1,167	1,313	1,458	1,750	3,500
18-0	900	1,200	1,350	1,500	1,800	3,600

3.11 CONCRETE FOR WALLS (PER 100 LIN FT OF WALL) (Cont.)

Height, ft-in.	Thickness					Forms, sq ft
	13 in.	14 in.	15 in.	16 in.	17 in.	
	Concrete, cu ft					
1-0	108	117	125	133	142	200
1-6	163	175	188	200	213	300
2-0	217	233	250	267	284	400
2-6	271	292	313	333	354	500
3-0	325	350	375	400	425	600
3-6	379	408	438	467	496	700
4-0	433	467	500	533	567	800
4-6	487	525	563	600	638	900
5-0	542	583	625	667	708	1,000
5-6	596	642	688	733	779	1,100
6-0	650	700	750	800	850	1,200
6-6	704	758	813	867	921	1,300
7-0	758	817	875	933	992	1,400
7-6	812	875	938	1,000	1,063	1,500
8-0	866	934	1,000	1,067	1,133	1,600
8-6	921	992	1,063	1,133	1,204	1,700
9-0	975	1,050	1,125	1,200	1,275	1,800
9-6	1,029	1,108	1,188	1,267	1,346	1,900
10-0	1,083	1,167	1,250	1,333	1,417	2,000
10-6	1,137	1,225	1,313	1,400	1,488	2,100
11-0	1,192	1,283	1,375	1,467	1,558	2,200
11-6	1,246	1,342	1,438	1,533	1,629	2,300
12-0	1,300	1,400	1,500	1,600	1,700	2,400
12-6	1,354	1,458	1,563	1,667	1,771	2,500
13-0	1,408	1,517	1,625	1,733	1,842	2,600
13-6	1,462	1,575	1,688	1,800	1,913	2,700
14-0	1,517	1,633	1,750	1,867	1,983	2,800
14-6	1,571	1,692	1,813	1,933	2,054	2,900
15-0	1,625	1,750	1,875	2,000	2,125	3,000
15-6	1,679	1,808	1,938	2,067	2,196	3,100
16-0	1,733	1,867	2,000	2,133	2,267	3,200
16-6	1,787	1,925	2,063	2,200	2,338	3,300
17-0	1,842	1,983	2,125	2,267	2,408	3,400
17-6	1,896	2,042	2,188	2,333	2,479	3,500
18-0	1,950	2,100	2,250	2,400	2,550	3,600

3.11 CONCRETE FOR WALLS (PER 100 LIN FT OF WALL) (Cont.)

Height, ft-in.	Thickness					Forms, sq ft
	18 in.	19 in.	20 in.	21 in.	24 in.	
	Concrete, cu ft					
1-0	150	158	167	175	200	200
1-6	225	238	250	263	300	300
2-0	300	317	333	350	400	400
2-6	375	396	417	438	500	500
3-0	450	475	500	525	600	600
3-6	525	554	583	613	700	700
4-0	600	633	667	700	800	800
4-6	675	713	750	788	900	900
5-0	750	792	833	875	1,000	1,000
5-6	825	871	917	963	1,100	1,100
6-0	900	950	1,000	1,050	1,200	1,200
6-6	975	1,029	1,083	1,138	1,300	1,300
7-0	1,050	1,108	1,167	1,225	1,400	1,400
7-6	1,125	1,188	1,250	1,313	1,500	1,500
8-0	1,200	1,267	1,333	1,400	1,600	1,600
8-6	1,275	1,346	1,417	1,488	1,700	1,700
9-0	1,350	1,425	1,500	1,575	1,800	1,800
9-6	1,425	1,504	1,583	1,663	1,900	1,900
10-0	1,500	1,583	1,667	1,750	2,000	2,000
10-6	1,575	1,663	1,750	1,838	2,100	2,100
11-0	1,650	1,742	1,833	1,925	2,200	2,200
11-6	1,725	1,821	1,917	2,013	2,300	2,300
12-0	1,800	1,900	2,000	2,100	2,400	2,400
12-6	1,875	1,979	2,083	2,188	2,500	2,500
13-0	1,950	2,058	2,167	2,275	2,600	2,600
13-6	2,025	2,138	2,250	2,363	2,700	2,700
14-0	2,100	2,217	2,333	2,450	2,800	2,800
14-6	2,175	2,296	2,417	2,538	2,900	2,900
15-0	2,250	2,375	2,500	2,625	3,000	3,000
15-6	2,325	2,454	2,583	2,713	3,100	3,100
16-0	2,400	2,533	2,667	2,800	3,200	3,200
16-6	2,475	2,613	2,750	2,888	3,300	3,300
17-0	2,550	2,692	2,833	2,975	3,400	3,400
17-6	2,625	2,771	2,917	3,063	3,500	3,500
18-0	2,700	2,850	3,000	3,150	3,600	3,600

3.12 CONCRETE FOR SLABS

Area, sq ft	Thickness									
	2"	2½"	3"	3½"	4"	4½"	5"	5½"	6"	6½"
	Cubic yards									
100	0.62	0.77	0.93	1.08	1.23	1.39	1.54	1.70	1.85	2.01
200	1.24	1.54	1.85	2.16	2.47	2.78	3.09	3.40	3.70	4.01
300	1.85	2.31	2.78	3.24	3.70	4.17	4.63	5.09	5.56	6.02
400	2.47	3.09	3.70	4.32	4.94	5.56	6.17	6.79	7.41	8.02
500	3.09	3.86	4.63	5.40	6.17	6.94	7.71	8.49	9.26	10.03
600	3.70	4.63	5.56	6.48	7.41	8.33	9.26	10.19	11.11	12.04
700	4.32	5.40	6.48	7.56	8.64	9.72	10.80	11.89	12.96	14.04
800	4.94	6.17	7.40	8.64	9.88	11.11	12.35	13.58	14.82	16.05
900	5.55	6.94	8.33	9.72	11.11	12.50	13.89	15.28	16.67	18.06
	Thickness									
	7"	7½"	8"	8½"	9"	9½"	10"	10½"	11"	12"
	Cubic yards									
100	2.16	2.32	2.47	2.62	2.78	2.93	3.09	3.24	3.40	3.70
200	4.32	4.63	4.94	5.25	5.56	5.86	6.17	6.48	6.79	7.41
300	6.48	6.95	7.41	7.87	8.33	8.79	9.26	9.72	10.19	11.11
400	8.64	9.26	9.88	10.49	11.11	11.73	12.35	12.96	13.58	14.82
500	10.80	11.58	12.35	13.12	13.89	14.66	15.43	16.20	16.98	18.52
600	12.96	13.89	14.81	15.74	16.67	17.59	18.52	19.44	20.37	22.22
700	15.12	16.20	17.28	18.36	19.44	20.52	21.60	22.69	23.77	25.93
800	17.28	18.52	19.75	20.99	22.22	23.46	24.69	25.93	27.16	29.63
900	19.44	20.83	22.22	23.61	25.00	26.39	27.78	29.17	30.56	33.34

To compute the concrete for any area not shown in Table 3.12, break the figure down, move the decimal point as necessary, and add the various results, as shown below:

- (1) 12,842 sq ft at 4½ in. thick:
- | | | |
|--------------|---|----------------------|
| 10,000 sq ft | = | 139.000 cu yd |
| 2,000 | = | 27.800 |
| 600 | = | 11.110 |
| 40 | = | 0.556 |
| 2 | = | 0.027 |
| 12,842 sq ft | = | 178.493 = 178½ cu yd |
- (2) 3,350 sq ft at 7 in. thick:
- | | | |
|-------------|---|-------------------|
| 3,000 sq ft | = | 64.80 |
| 300 | = | 6.48 |
| 50 | = | 1.08 |
| 3,350 sq ft | = | 72.36 = 72½ cu yd |

3.13 CONCRETE FOR SQUARE COLUMNS

Column size, in.	Concrete per lin ft of height, cu ft	Column size, in.	Concrete per lin ft of height, cu ft
10 × 10	0.70	25 × 25	4.34
11 × 11	0.84	26 × 26	4.69
12 × 12	1.00	27 × 27	5.06
13 × 13	1.17	28 × 28	5.44
14 × 14	1.36	29 × 29	5.84
15 × 15	1.56	30 × 30	6.25
16 × 16	1.78	31 × 31	6.67
17 × 17	2.01	32 × 32	7.11
18 × 18	2.25	33 × 33	7.56
19 × 19	2.51	34 × 34	8.03
20 × 20	2.78	35 × 35	8.51
21 × 21	3.06	36 × 36	9.00
22 × 22	3.36	37 × 37	9.51
23 × 23	3.67	38 × 38	10.03
24 × 24	4.00	39 × 39	10.56

3.14 CONCRETE FOR ROUND COLUMNS AND COLUMN CAPITALS

Column dia., in	Concrete per lin ft of height, cu ft	3'6" dia.	4'0" dia.	4'6" dia.	5'0" dia.	5'6" dia.	6'0" dia.
		Additional concrete for capitals, cu ft					
12	0.8	7.8	8.9	12.9	17.7	23.6	30.7
14	1.0	7.6	8.8	12.6	17.4	23.2	30.2
16	1.4	6.9	8.1	11.8	16.5	22.3	29.2
18	1.8	6.4	7.4	11.1	15.7	21.2	28.2
20	2.2	5.9	6.8	10.4	14.9	20.6	27.2
22	2.6	5.4	6.5	9.9	14.3	19.7	26.4
24	3.1	4.8	5.8	9.3	13.5	18.7	25.2
26	3.6	4.2	5.2	8.5	12.7	17.8	24.1
28	4.2	3.6	4.6	7.7	11.7	16.7	22.9
30	4.9	3.2	4.1	7.0	10.9	15.7	21.8
32	5.6	2.2	3.1	5.8	9.5	14.2	20.0
34	6.3	1.8	2.6	5.2	8.6	13.2	18.9
36	7.0				8.0	12.4	17.8
38	7.9				6.8	10.9	16.2
40	8.7				6.0	9.8	15.0
42	9.6				5.2	8.9	13.7
44	10.5						
46	11.5						
48	12.6						

These quantities for capitals (flared caps) are extra, excluding the concrete in the round column. Therefore the concrete in the round column must be figured for the full height, slab to slab.

3.15 CEMENT TOPPING

Materials for 100 sq ft

Thickness, in.	Proportions						
	1:1½		1:2		1:1:1		
	Cement, sacks	Sand, cu yd	Cement, sacks	Sand, cu yd	Cement, sacks	Sand, cu yd	Stone, cu yd
1	2.4	0.13	2.0	0.15	2.1	0.08	0.08
1	3.6	0.19	2.9	0.22	3.1	0.11	0.11
1	4.8	0.26	3.9	0.29	4.2	0.15	0.15
1	6.0	0.33	4.9	0.36	5.2	0.19	0.19
1	7.2	0.40	5.9	0.43	6.3	0.23	0.23
1	8.4	0.46	6.9	0.50	7.3	0.27	0.27
2	9.6	0.53	7.9	0.58	8.3	0.31	0.31

Thickness, in.	Proportions					
	1:1:1½			1:1:2		
	Cement, sacks	Sand, cu yd	Stone, cu yd	Cement, sacks	Sand, cu yd	Stone, cu yd
1	1.8	0.07	0.10	1.6	0.06	0.12
1	2.7	0.10	0.15	2.4	0.09	0.18
1	3.7	0.14	0.20	3.2	0.12	0.24
1	4.6	0.17	0.25	4.1	0.15	0.30
1	5.5	0.20	0.30	4.9	0.18	0.36
1	6.4	0.24	0.36	5.7	0.21	0.42
2	7.3	0.27	0.41	6.5	0.25	0.50

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3.16 CEMENT PLASTER AND STUCCO (Materials for 100 sq ft)

Thick- ness, in.	Mor- tar, cu ft	1:2 mix		1:2½ mix		1:3 mix		1:3½ mix	
		Ce- ment, sacks	Sand, cu ft	Ce- ment, sacks	Sand, cu ft	Ce- ment, sacks	Sand, cu ft	Ce- ment, sacks	Sand, cu ft
½	2.3	1.0	2.1	0.9	2.2	0.7	2.3	0.7	2.3
	3.5	1.5	3.1	1.3	3.3	1.1	3.4	1.0	3.5
	4.6	2.1	4.1	1.7	4.3	1.5	4.5	1.3	4.7
	5.7	2.6	5.1	2.2	5.4	1.9	5.7	1.7	5.8
	6.9	3.1	6.2	2.6	6.5	2.3	6.8	2.0	7.0
1	9.2	4.1	8.2	3.5	8.7	3.0	9.1	2.6	9.3

3.17 FLOOR TOPPING (Cement floor fill or granolithic floor topping)

Thickness of topping, in.	Area per cubic yard of mix, sq ft	Mix per 100 sq ft of floor, cu ft
½	1,296	2.08
	648	4.17
	432	6.25
1	324	8.33
1½	260	10.42
1	216	12.50
1	185	14.58
2	162	16.67
2½	144	18.75
2	129	20.83
2	118	22.92
3	108	25.00

3.18 CONCRETE DISPLACED BY METAL PAN FORMS*

Square-Dome Pans

Dimensions, in. (Third Figure is Depth)	Concrete Displaced per Dome, cu ft
30 × 30 × 8	3.65
30 × 30 × 10	4.78
30 × 30 × 12	5.53
30 × 30 × 14	6.54
19 × 19 × 4	0.77
19 × 19 × 6	1.09
19 × 19 × 8	1.41
19 × 19 × 10	1.90
19 × 19 × 12	2.14

Long Metal Pan Forms

Width, in.	Depth				
	6 in.	8 in.	10 in.	12 in.	14 in.
	Concrete displaced per lineal foot of pan, cu ft				
10	0.39	0.52	0.64	0.75	0.86
15	0.60	0.79	0.98	1.17	1.35
20	0.81	1.07	1.33	1.58	1.83
30	1.23	1.63	2.02	2.42	2.80

Taper End Form (3 ft Long)

Width, in.	Depth				
	6 in.	8 in.	10 in.	12 in.	14 in.
	Concrete displaced, cu ft				
20	2.20	2.92	3.60	4.30	5.00
30	3.10	4.50	5.56	6.75	7.88

*The quantities given are average; the exact displacement varies slightly, according to the make of pan used.

3.19 STRUCTURAL CLAY TILE AND CONCRETE FOR FLOORS
(Average Quantities per 100 sq ft of Slab)

Slab depth, in. (tile + concrete)	4-in. joist		5-in joist		8-in. joist	
	Tile, sq ft	Concrete, cu yd	Tile, sq ft	Concrete, cu yd	Tile, sq ft	Concrete, cu yd
6 + 1½	75	0.93	71	1.01	67	1.08
6 + 2	75	1.08	71	1.18	67	1.23
6 + 2½	75	1.24	71	1.32	67	1.38
8 + 2	75	1.24	71	1.34	67	1.43
8 + 2½	75	1.39	71	1.49	67	1.59
8 + 3	75	1.54	71	1.65	67	1.74
10 + 2	75	1.39	71	1.52	67	1.64
10 + 2½	75	1.54	71	1.68	67	1.80
10 + 3	75	1.69	71	1.83	67	1.95
12 + 2	75	1.54	71	1.70	67	1.85
12 + 2½	75	1.69	71	1.86	67	2.00
12 + 3	75	1.85	71	2.01	67	2.16

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3.20 CONCRETE FOR STEEL DECK
(Concrete Fill over Ribbed or Cellular Steel Deck)

Make	Types	Concrete per sq ft in ribs only, cu ft	Thickness		
			2 in.	2½ in.	3 in.
			Concrete per sq ft in slab plus ribs, cu ft		
Airtherm	CFB	0.05	0.22	0.26	0.30
Bowman	OF (Inverted); OP	0.04	0.21	0.25	0.29
Fenestra	D Panel 1½" deep	0.03	0.20	0.24	0.28
	D Panel 3" deep	0.06	0.23	0.27	0.31
	D Panel 4½" deep	0.09	0.26	0.30	0.34
	TAC 6" deep	0.13	0.29	0.33	0.38
	TAC 8" deep	0.17	0.33	0.38	0.43
	Holorib (ribs up)	0.12	0.29	0.33	0.37
Inland	BB; BC	0.04	0.21	0.25	0.29
	B; BF	0.05	0.22	0.26	0.30
	CF	0.17	0.34	0.38	0.42
Metrodeck	Deep ribs 2" × 1½"	0.05	0.22	0.26	0.30
	Deep ribs 2½" × 1½"	0.08	0.25	0.29	0.33
Mahon	M Panel 6 in.	0.13	0.29	0.33	0.38
	M Panel 7½ in.	0.16	0.32	0.37	0.41
Robertson	K; RK; UK	0.05	0.22	0.26	0.30
	FK; DK	0.17	0.34	0.38	0.42
Granco	Standard Corruform	0.03	0.20	0.23	0.27
	Tufcor 26 G	0.04	0.21	0.25	0.29
	Tufcor 24 G	0.05	0.22	0.26	0.31
	Tufcor 22 G	0.05	0.22	0.26	0.31
	Tufcor 20 G	0.06	0.22	0.27	0.31
	Tufcor 18 G	0.06	0.23	0.27	0.31
Inland Ribform	Standard	0.03	0.20	0.23	0.27
	Heavy duty	0.04	0.21	0.25	0.29
	Super duty	0.05	0.22	0.26	0.31
Steeltex	Paper-backed Mesh	Add 10% for sag	0.19	0.23	0.28

3.21 REINFORCING STEEL: SIZES AND WEIGHTS

Bar No.	Old size, in.	Weight, lb per lin ft	Cross section area, sq in.
2	1 round	0.167	0.05
3		0.376	0.11
4		0.668	0.20
5		1.043	0.31
6		1.502	0.44
7		2.044	0.60
8		2.670	0.79
9	1 square	3.400	1.00
10		4.303	1.27
11		5.313	1.56

3.22 LAP OF REINFORCING BARS (In inches)

Number of diameters	Size of bar								
	#3	#4	#5	#6	#7	#8	#9	#10	#11
20			13	15	18	20	23	26	29
21			14	16	19	21	24	27	30
22			14	17	20	22	25	28	31
23		12	15	18	21	23	26	30	33
24		12	15	18	21	24	28	31	34
25		13	16	19	22	25	29	32	36
26		13	17	20	23	26	30	33	37
27		14	17	21	24	27	31	35	39
28		14	18	21	25	28	32	36	40
29		15	19	22	26	29	33	37	41
30	12	15	19	23	27	30	34	39	43
31	12	16	20	24	28	32	36	41	45
32	13	17	22	26	30	34	39	44	48
34	14	18	23	27	32	36	41	46	51
36	15	19	24	29	34	38	43	49	54
40	15	20	25	30	35	40	46	51	57

Minimum lap equals 12 in.; all laps figured to next larger whole inch.

3.23 REINFORCED LINTELS

Reinforced Concrete Lintels

Clear opening, ft	Total load, lb	Size, in.	Wall thickness, in.	No. and size of bars (round)	Cu ft of concrete per ft	Lb of steel per ft
3	400	6 × 8	6	2 - $\frac{1}{4}$ "	0.33	0.33
	535	8 × 8	8	2 - $\frac{1}{4}$ "	0.45	0.33
	800	12 × 8	12	2 - $\frac{1}{4}$ "	0.67	0.33
4	625	6 × 8	6	2 - $\frac{1}{4}$ "	0.33	0.33
	835	8 × 8	8	2 - $\frac{1}{4}$ "	0.45	0.33
	1,250	12 × 8	12	2 - $\frac{1}{4}$ "	0.67	0.33
6	1,250	6 × 8	6	3 - $\frac{1}{4}$ "	0.33	0.50
	1,670	8 × 8	8	3 - $\frac{1}{4}$ "	0.45	0.50
	2,500	12 × 8	12	2 - $\frac{1}{2}$ "	0.67	0.75
8	2,000	6 × 8	6	{ 1 - $\frac{1}{2}$ " }	0.33	1.05
	2,670	8 × 8	8	{ 1 - $\frac{1}{2}$ " }	0.45	1.13
	4,000	12 × 8	12	{ 2 - $\frac{1}{2}$ " }	0.67	1.71

All loads calculated on triangular loading at 45 deg; no stirrups required.

Reinforced Brick Lintels

Clear opening	Load, lb	Beam size, in.	No. and size of bars (round)
3	640	8 × 13 $\frac{1}{2}$	2 - $\frac{1}{4}$ "
4	1,000	8 × 13 $\frac{1}{2}$	2 - $\frac{1}{4}$ "
6	1,960	8 × 13 $\frac{1}{2}$	3 - $\frac{1}{4}$ "
8	3,240	8 × 13 $\frac{1}{2}$	6 - $\frac{1}{4}$ "

The loads and bars given for the different spans are adequate to care for a 12-in. wall. Flat arches should be bonded to beams with wire ties for 12-in. walls. No stirrups are required.

3.24 BAR SUPPORT SPECIFICATIONS AND STANDARD NOMENCLATURE

Symbol	Bar support	Top wire*	Legs*	Description
SB	Slab bolster	No. 4 corrugated	$\frac{3}{4}$ " high No. 7	Legs spaced 5" centers; corrugations vertical or flat, spaced 1" centers; heights up to 2"; stocked in $\frac{3}{4}$ ", 1", 1 $\frac{1}{2}$ ", and 2" heights and 5- and 10- ft lengths
SBR	Slab bolster with runners	No. 4 corrugated	Same as SB	Same as SB with No. 7 wire runners
SS	Slab spacer	No. 5 smooth	Same as SB	Legs spaced to provide supporting leg under each bar; minimum leg spacing 4"; heights up to 2"; fabricated to order
BB	Beam bolster	No. 7 smooth	No. 7	All legs spaced 2" centers; max. height, 3"; stocked in 1", 1 $\frac{1}{2}$ ", and 2" heights and 5-ft lengths
HBB	Heavy beam bolster	No. 4 smooth	No. 4	Same as BB except max. height 5"
BBU	Beam bolster upper	No. 7 smooth	No. 7	All legs spaced 2" centers; max. height 3"; stocked in 1", 1 $\frac{1}{2}$ ", and 2" heights and 5-ft lengths
HBBU	Heavy beam bolster upper	No. 4 smooth	No. 4	Same as BBU except max. height 5"; fabricated to order
BC	Bar chair	No. 8	No. 8	Made and stocked only in $\frac{3}{4}$ ", 1", 1 $\frac{1}{2}$ ", and 1 $\frac{3}{4}$ " heights
JC	Jolst chair	No. 8	No. 8	Made and stocked only in 4", 5", and 6" widths and $\frac{3}{4}$ ", 1", and 1 $\frac{1}{2}$ " heights
HC	Individual high chairs	No. 5 for 2" to 4" No. 4 for 4" to 6" No. 2 for 6" to 9" No. 0 over 9"		Stocked in $\frac{1}{4}$ " increments from 2" to 6"

3.24 BAR SUPPORT SPECIFICATIONS AND STANDARD NOMENCLATURE (Cont.)

Symbol	Bar support	Top wire*	Legs *	Description
CHC	Continuous high chairs	No. 2 for 2" to 6" No. 0 for over 6"	Same as HC	All legs 12" centers; fabricated to order
CHCU	Continuous high chairs upper	Same as CHC	Same as HC	Same as CHC with No. 5 wire runners
HCHC	Heavy continuous high chairs	Same as CHC	Same as HC	Legs 8" centers; fabricated to order

*AS & W wire gauges indicated in this table are the minimum sizes to be used.

3.25 WELDED WIRE MESH

Size	Weight per 100 sq ft, lb	Weight per roll, lb
6" × 6" - 10/10	21	157.5
6" × 6" - 8/8	30	225.0
6" × 6" - 6/6	42	315.0
6" × 6" - 4/4	58	435.0
4" × 4" - 10/10	31	232.5
4" × 4" - 8/8	44	330.0
4" × 4" - 6/6	62	465.0
4" × 4" - 4/4	85	637.5
2" × 2" - 14/14	21	157.5*
2" × 2" - 12/12	37	277.5*

The figures in the last column are based on a standard roll of 150 ft × 5 ft (750 sq ft). Rolls of 200 ft and of 300 ft are also available on mill orders.

*Supplied galvanized only.

3.26 CONCRETE PAINTS

Materials	Use	Quantity per coat, sq ft per gal except as noted
Floor paint (oil base)	On new concrete floors	300
	On old concrete floors	200
Floor sealer (liquid)	Colorless	450
	Colored	300
Paste wax	Waxing concrete floors	200 sq ft per lb
Liquid wax	Waxing concrete floors	2,500
Cement-pigment paint	Exterior concrete walls	130 sq ft per 10 lb
Casein base paint	Exterior concrete walls	300
Cement base water repellent paint	Exterior concrete walls	100 sq ft per 8 lb
Flat oil paint	Exterior concrete walls	100
Sealer, colorless	Exterior walls	100
Sealer, colored	Exterior walls	70
Asphaltic paint	Walls and ceiling	75
Interior flat oil paint	Interior walls and ceilings	175
Interior priming paint	Interior walls and ceilings	500
Limewash (whitewash)	Exterior walls	200
	Interior walls and ceilings	250

Materials for whitewash: 50 lb of hydrated lime plus 6 to 6½ gal of water equal 8 gal whitewash.

3.27 CONCRETE FLOOR TREATING MATERIALS

<u>Material</u>	<u>Quantity</u>
Curing compound (liquid)	300 sq ft per gal
Floor hardener (liquid)	300 sq ft per gal (1 coat) 150 sq ft per gal (2 coats) 100 sq ft per gal (3 coats)
Metallic floor hardener, light duty	30 lb per 100 sq ft
Metallic floor hardener, medium duty	40 lb per 100 sq ft
Metallic floor hardener, heavy duty	50-70 lb per 100 sq ft
Nonslip abrasive aggregate	25-60 lb per 100 sq ft
Color admix (integral)	5 lb per bag of cement
Color admix (integral) for 1-in. topping 1:1:2	15 lb per 100 sq ft
Carbon black admix (integral)	10 lb per bag of cement
Carbon black admix (integral) for 1-in. topping 1:1:2	30 lb per 100 sq ft
Floor coloring (dust on)	25 lb per 100 sq ft (1 coat) 50 lb per 100 sq ft (2 coats)
Conductive heavy-duty iron aggregate	150-180 lb per 100 sq ft
Floor sealer (liquid, brush applied), colored	300 sq ft per gal
Floor sealer (liquid, brush applied), transparent	450 sq ft per gal
Bond coat (for new floor topping over old floor), liquid	300 sq ft
Bond coat (for new floor topping over old floor), powder	25 lb per 100 sq ft

3.28 CONCRETE ACCELERATORS AND WATERPROOFING ADMIXES

<u>Use</u>	<u>Type of material</u>	<u>Quantity</u>
Waterproofing admix	Powder (add to mixing water)	2 lb per bag of cement
	Liquid (add to mixing water)	1 qt per bag of cement
Air-entraining admix	Powder (add to mixing water)	$\frac{1}{4}$ lb per bag of cement
	Liquid (add to mixing water)	1 oz per bag of cement
Accelerators (anti-freeze)	Calcium chloride	2 lb per bag of cement
	Liquid	1 qt per bag of cement
	Powder	1 lb per bag of cement
Accelerator, using hi-early cement		Premixed (costs 25 cents per bag of cement extra)

SECTION IV

Masonry

4.1 STRUCTURAL FACING TILE

Modular coursing	Coursing, in. (vertical × horizontal)	No. of tiles per sq ft
4 S Series	2½ × 8	6.75
6 P Series	4 × 12	3.00
4 D Series	5½ × 8	3.37
6 T Series	5½ × 12	2.25
8 W Series	8 × 16	1.12
4 S Series (2½ × 7½)	2½ × 7½	7.31
	2½ × 8	7.20
	2½ × 7½	8.97
	2½ × 8	6.86
	2½ × 8½	6.75
	2½ × 8	6.75
	2½ × 8½	6.65
6 P Series (3½ × 11½)	4 × 11½	3.03
	4 × 12	3.00
	4 × 12½	2.97
	4½ × 11½	2.94
	4½ × 12	2.91
	4½ × 12½	2.88
4 D Series (5½ × 7½)	5½ × 7½	3.48
	5½ × 8	3.43
	5½ × 8½	3.37
	5½ × 7½	3.43
	5½ × 8	3.37
	5½ × 8½	3.32
	5½ × 7½	3.40
	5½ × 8	3.35
	5½ × 8½	3.30
	5½ × 7½	3.32
	5½ × 8	3.27
	5½ × 8½	3.22
6 T Series (5½ × 11½)	5½ × 11½	2.31
	5½ × 12	2.29
	5½ × 12½	2.26
	5½ × 12	2.23
	5½ × 12½	2.23
	5½ × 12	2.23
	5½ × 12½	2.21
	5½ × 12	2.18
	5½ × 12½	2.16
8 W Series (7½ × 15½)	8 × 15½	1.13
	8 × 16	1.12
	8 × 16½	1.12
	8½ × 16	1.11
	8½ × 16½	1.10
	8½ × 16	1.10
	8½ × 16½	1.08
	8½ × 16½	1.07

4.2 BRICK COURSING

All coursing is the dimension of the brick plus joint. All quantities per square foot are for one brick thickness.

Modular coursing:	Vertical, in.	Horizontal, in.	No. of bricks per sq ft
Standard	2	8	6.75
Norman	2	12	4.50
Roman	2	12	6.00
Standard size	2	7 $\frac{1}{8}$	7.70
	2	8	7.58
	2	8 $\frac{1}{8}$	7.46
	2	8 $\frac{1}{4}$	7.35
	2	7 $\frac{1}{2}$	7.31
	2	8	7.20
	2	8 $\frac{1}{8}$	7.09
	2	8 $\frac{1}{4}$	6.98
	2	7 $\frac{1}{8}$	6.97
	2	8	6.86
	2	8 $\frac{1}{8}$	6.75
	2	8 $\frac{1}{4}$	6.65
	2	7 $\frac{1}{2}$	6.86
	2	8	6.75
	2	8 $\frac{1}{8}$	6.65
	2	8 $\frac{1}{4}$	6.55
	2	7 $\frac{1}{8}$	6.65
	2	8	6.55
	2	8 $\frac{1}{8}$	6.45
	2	8 $\frac{1}{4}$	6.35
Norman size	2	11 $\frac{1}{8}$	5.11
	2	12	5.05
	2	12 $\frac{1}{8}$	5.00
	2	11 $\frac{1}{2}$	4.85
	2	12	4.80
	2	12 $\frac{1}{4}$	4.75
	2	11 $\frac{1}{4}$	4.62
	2	12	4.57
	2	12 $\frac{1}{8}$	4.52
	2	11 $\frac{1}{8}$	4.55
	2	12	4.50
	2	12 $\frac{1}{4}$	4.45

4.2 BRICK COURSING (Cont.)

	Vertical, in.	Horizontal, in.	No. of bricks per sq ft
Roman size	1 $\frac{1}{8}$	11 $\frac{1}{8}$	6.47
	1 $\frac{1}{8}$	12	6.40
	1 $\frac{1}{8}$	12 $\frac{1}{8}$	6.33
	2	11 $\frac{1}{8}$	6.06
	2	12	6.00
	2	12 $\frac{1}{8}$	5.94
	2 $\frac{1}{8}$	11 $\frac{1}{8}$	5.71
	2 $\frac{1}{8}$	12	5.65
	2 $\frac{1}{8}$	12 $\frac{1}{8}$	5.59
Jumbo size	3	7 $\frac{1}{8}$	6.10
	3	8	6.00
	3	8 $\frac{1}{8}$	5.91
	3	8 $\frac{1}{4}$	5.82
	3 $\frac{1}{8}$	7 $\frac{1}{8}$	5.85
	3 $\frac{1}{8}$	8	5.76
	3 $\frac{1}{8}$	8 $\frac{1}{8}$	5.67
	3 $\frac{1}{8}$	8 $\frac{1}{4}$	5.59
	3 $\frac{1}{4}$	7 $\frac{1}{8}$	5.63
	3 $\frac{1}{4}$	8	5.54
	3 $\frac{1}{4}$	8 $\frac{1}{8}$	5.45
	3 $\frac{1}{4}$	8 $\frac{1}{4}$	5.37
Oversize	3 $\frac{3}{8}$	7 $\frac{1}{8}$	5.22
	3 $\frac{3}{8}$	8	5.14
	3 $\frac{3}{8}$	8 $\frac{1}{8}$	5.06
	3 $\frac{3}{8}$	8 $\frac{1}{4}$	4.99
	3 $\frac{3}{4}$	7 $\frac{1}{8}$	5.04
	3 $\frac{3}{4}$	8	4.97
	3 $\frac{3}{4}$	8 $\frac{1}{8}$	4.89
	3 $\frac{3}{4}$	8 $\frac{1}{4}$	4.81

4.3 MASONRY—BRICK BONDS

Bond	Description	Add to face area for headers in the backup area	Add for cutting and waste
Running (all-stretcher) Full Flemish	No headers Alternating headers, stretchers in every course	None	5% 3%
Flemish every 2nd	1 stretcher course, 1 Flemish course	One third (33.3%)	3%
Flemish every 3rd	2 stretcher courses, 1 Flemish course	One sixth (16.7%)	3%
Flemish every 4th	3 stretcher courses, 1 Flemish course	One ninth (11.1%)	3%
Flemish every 5th	4 stretcher courses, 1 Flemish course	One twelfth (8.3%)	4%
Flemish every 6th	5 stretcher courses, 1 Flemish course	One fifteenth (6.7%)	4%
Flemish every 7th	6 stretcher courses, 1 Flemish course	One eighteenth (5.6%)	4%
Double Flemish	2 stretchers to 1 header in every course	One twenty-first (4.8%)	5%
Double Flemish in 2nd	1 stretcher course, 1 course of 2 stretchers to 1 header	One fifth (20.0%)	3%
Double Flemish in 3rd	2 stretcher courses, 1 course of 2 stretchers to 1 header	One tenth (10.0%)	3%
Double Flemish in 4th	3 stretcher courses, 1 course of 2 stretchers to 1 header	One fifteenth (6.7%)	4%
Double Flemish in 5th	4 stretcher courses, 1 course of 2 stretchers to 1 header	One twentieth (5.0%)	4%
		One twenty-fifth (4.0%)	5%

4.3 MASONRY—BRICK BONDS (Cont.)

Bond	Description	Add to face area for headers in the backup area	Add for cutting and waste
Double Flemish in 6th	5 stretcher courses, 1 course of 2 stretchers to 1 header	One thirtieth (3.3%)	5%
Double Flemish in 7th	6 stretcher courses, 1 course of 2 stretchers to 1 header	One thirty-fifth (2.9%)	5%
3 stretcher garden wall bond	Every course has 3 stretchers to 1 header	One seventh (14.3%)	4%
Full English	1 stretcher course, 1 header course	One half (50.0%)	15%
2 stretcher English	2 stretcher courses, 1 header course	One third (33.3%)	12%
3 stretcher English	3 stretcher courses, 1 header course	One quarter (25.0%)	11%
4 stretcher English	4 stretcher courses, 1 header course	One fifth (20.0%)	10%
5 stretcher English	5 stretcher courses, 1 header course	One sixth (16.7%)	9%
6 stretcher English	6 stretcher courses, 1 header course	One seventh (14.3%)	8%

Snapped headers: When a bond pattern is required to show on the face but with only certain courses having full headers, the waste allowance must be increased for the snapped headers. As an example, take a Flemish bond with snapped headers in 5 courses and full headers in every sixth course. For the "add for bond" allowance the bond is Flemish in the 6th; add one eighteenth. To allow for the loss of cutting bricks to make snap headers, an additional 5% is needed, making a total waste of 9%.

For 8-in. walls with face brick both sides, there is nothing to add for headers, no matter what bond is used.

4.4 CINDER BLOCK AND CONCRETE BLOCK

Use also for all lightweight partition blocks in the 8×16 and 8×18 sizes.

Size	Coursing, in. (vertical \times horizontal)	No. of blocks per sq ft
Modular coursing	4×8	4.50
	4×12	3.00
	4×16	2.25
	4×18	2.00
	8×8	2.25
	8×12	1.50
	8×16	1.12
	8×18	1.00
8×16	$7\frac{1}{2} \times 16$	1.20
	$7\frac{1}{2} \times 16\frac{1}{2}$	1.19
	$7\frac{1}{2} \times 16\frac{1}{4}$	1.19
	$7\frac{1}{2} \times 16$	1.18
	$7\frac{1}{2} \times 16\frac{1}{2}$	1.17
	$7\frac{1}{2} \times 16\frac{3}{4}$	1.16
	$7\frac{1}{2} \times 16$	1.16
	$7\frac{1}{2} \times 16\frac{1}{2}$	1.15
	$7\frac{1}{2} \times 16\frac{1}{4}$	1.14
	$7\frac{1}{2} \times 16$	1.14
	$7\frac{1}{2} \times 16\frac{1}{2}$	1.13
	$7\frac{1}{2} \times 16\frac{1}{4}$	1.12
	8×16	1.12
	$8 \times 16\frac{1}{2}$	1.12
	$8 \times 16\frac{1}{4}$	1.11
	$8\frac{1}{2} \times 16$	1.11
	$8\frac{1}{2} \times 16\frac{1}{2}$	1.10
	$8\frac{1}{2} \times 16\frac{1}{4}$	1.08
	$8\frac{1}{2} \times 16$	1.10
	$8\frac{1}{2} \times 16\frac{1}{2}$	1.08
	$8\frac{1}{2} \times 16\frac{1}{4}$	1.07

4.4 CINDER BLOCK AND CONCRETE BLOCK (Cont.)

Size	Coursing, in. (vertical \times horizontal)	No. of blocks per sq ft
8 \times 18	7 $\frac{1}{2}$ \times 18	1.07
	7 $\frac{1}{2}$ \times 18 $\frac{1}{2}$	1.06
	7 $\frac{1}{2}$ \times 18 $\frac{1}{4}$	1.05
	7 $\frac{3}{4}$ \times 18	1.05
	7 $\frac{3}{4}$ \times 18 $\frac{1}{2}$	1.04
	7 $\frac{3}{4}$ \times 18 $\frac{1}{4}$	1.03
	7 $\frac{7}{8}$ \times 18	1.03
	7 $\frac{7}{8}$ \times 18 $\frac{1}{2}$	1.02
	7 $\frac{7}{8}$ \times 18 $\frac{1}{4}$	1.02
	7 $\frac{1}{2}$ \times 18	1.02
	7 $\frac{1}{2}$ \times 18 $\frac{1}{2}$	1.01
	7 $\frac{1}{2}$ \times 18 $\frac{1}{4}$	1.00
	8 \times 18	1.00
	8 \times 18 $\frac{1}{2}$	0.99
	8 \times 18 $\frac{1}{4}$	0.99
	8 $\frac{1}{2}$ \times 18	0.98
	8 $\frac{1}{2}$ \times 18 $\frac{1}{2}$	0.98
	8 $\frac{1}{2}$ \times 18 $\frac{1}{4}$	0.97
	8 $\frac{1}{4}$ \times 18 $\frac{1}{2}$	0.97
	8 $\frac{1}{4}$ \times 18 $\frac{1}{4}$	0.96
	8 $\frac{1}{4}$ \times 18 $\frac{1}{2}$	0.96

7 $\frac{1}{2}$ " coursing (block is 7 $\frac{1}{2}$ " \pm) is for 3 brick courses at 2 $\frac{1}{2}$ "

7 $\frac{3}{4}$ " coursing (block is 7 $\frac{3}{4}$ " \pm) is for 3 brick courses at 2 $\frac{1}{4}$ "

8" coursing (block is 7 $\frac{7}{8}$ " \pm) is for 3 brick courses at 2 $\frac{3}{8}$ "

8 $\frac{1}{2}$ " coursing (block is 7 $\frac{1}{2}$ " \pm) is for 3 brick courses at 2 $\frac{1}{4}$ "

The 7 $\frac{1}{2}$ ", 7 $\frac{3}{4}$ ", and 8 $\frac{1}{2}$ " coursing would be used only either if so specified or to work story heights or ceiling heights.

4.5 BRICK COURSING—VERTICAL

Course No.	Height of brick plus joint							
	1½ in.	2 in.	2½ in.	2¾ in.	3 in.	3½ in.	3¾ in.	4 in.
	Vertical height, ft.-in.							
1	0-1½	0-2	0-2½	0-2¾	0-3	0-3½	0-3¾	0-4
2	0-3½	0-4	0-4½	0-4¾	0-5	0-5½	0-5¾	0-6
3	0-5½	0-6	0-6½	0-7	0-7½	0-8	0-8½	0-9
4	0-7½	0-8	0-8½	0-9	0-10	0-10½	0-10¾	0-11
5	0-9½	0-10	0-11½	0-11¾	1- ½	1- 1½	1- 1¾	1- 2
6	0-11½	1- 0	1- 1½	1- 2¾	1- 3	1- 3½	1- 4	1- 4½
7	1- 1½	1- 2	1- 3½	1- 4¾	1- 5½	1- 6	1- 6½	1- 7
8	1- 3	1- 4	1- 6	1- 7	1- 8	1- 9	1- 9½	1-10
9	1-4½	1- 6	1- 8½	1- 9¾	1-10½	1-11½	2- 0	2- ½
10	1- 6½	1- 8	1-10½	1-11¾	2- 1	2- 2½	2- 2¾	2- 3½
11	1- 8½	1-10	2- ½	2- 2¾	2- 3½	2- 4½	2- 5½	2- 6½
12	1-10½	2- 0	2- 3	2- 4½	2- 6	2- 7½	2- 8	2- 9
13	2- 1½	2- 2	2- 5½	2- 6¾	2- 8½	2-10½	2-10¾	2-11½
14	2- 2½	2- 4	2- 7½	2- 9	2-11	3- ½	3- 1½	3- 2½
15	2- 4½	2- 6	2- 9½	2-11½	3- 1½	3- 3½	3- 4	3- 5½
16	2- 6	2- 8	3- 0	3- 2	3- 4	3- 6	3- 6½	3- 8
17	2- 7½	2-10	3- 2½	3- 4½	3- 6½	3- 8½	3- 9½	3-10½
18	2- 9½	3- 0	3- 4½	3- 6½	3- 9	3-11½	4- 0	4- 1½
19	2-11½	3- 2	3- 8½	3- 9½	3-11½	4- 1½	4- 2½	4- 4½
20	3- 1½	3- 4	3- 9	3-11½	4- 2	4- 4½	4- 5½	4- 7
21	3- 3½	3- 6	3-11½	4- 1½	4- 4½	4- 7½	4- 8	4- 9½
22	3- 5½	3- 8	4- 1½	4- 4½	4- 7	4- 9½	4-10½	5- 1½
23	3- 7½	3-10	4- 3½	4- 6½	4- 9½	5- ½	5- 1½	5- 3½
24	3- 9	4- 0	4- 6	4- 9	5- 0	5- 3	5- 4	5- 6
25	3-10½	4- 2	4- 8½	4-11½	5- 2½	5- 5½	5- 6½	5- 8½
26	4- ½	4- 4	4-10½	5- 1½	5- 5	5- 8½	5- 9½	5-11½
27	4- 2½	4- 6	5- ½	5- 4½	5- 7½	5-10½	6- 0	6- 2½
28	4- 4½	4- 8	5- 3	5- 6½	5-10	6- 1½	6- 2½	6- 5
29	4- 6½	4-10	5- 5½	5- 8½	6- ½	6- 4½	6- 5½	6- 7½
30	4- 8½	5- 0	5- 7½	5-11½	6- 3	6- 6½	6- 8	6-10½
31	4-10½	5- 2	5- 9½	6- 1½	6- 5½	6- 9½	6-10½	7- 1½
32	5- 0	5- 4	6- 0	6- 4	6- 8	7- 0	7- 1½	7- 4
33	5- 1½	5- 6	6- 2½	6- 6½	6-10½	7- 2½	7- 4	7- 6½
34	5- 3½	5- 8	6- 4½	6- 8½	7- 1	7- 5½	7- 6½	7- 9½
35	5- 5½	5-10	6- 6½	6-11½	7- 3½	7- 7½	7- 9½	8- 1½

4.5 BRICK COURSING—VERTICAL (Cont.)

Course No.	Height of brick plus joint							
	1½ in.	2 in.	2½ in.	3 in.	3½ in.	4 in.	4½ in.	5 in.
	Vertical height, ft.-in.							
36	5- 7½	6- 0	6- 9	7- 1½	7- 6	7-10½	8- 0	8- 3
37	5- 9½	6- 2	6-11½	7- 3½	7- 8½	8- 1½	8- 2½	8- 5½
38	5-11½	6- 4	7- 1½	7- 6½	7-11	8- 3½	8- 5½	8- 8½
39	6- 1½	6- 6	7- 3½	7- 8½	8- 1½	8- 6½	8- 8	8-11½
40	6- 3	6- 8	7- 6	7-11	8- 4	8- 9	8-10½	9- 2
41	6- 4½	6-10	7- 8½	8- 1½	8- 6½	8-11½	9- 1½	9- 4½
42	6- 6½	7- 0	7-10½	8- 3½	8- 9	9- 2½	9- 4	9- 7½
43	6- 8½	7- 2	8- 1½	8- 6½	8-11½	9- 4½	9- 6½	9-10½
44	6-10½	7- 4	8- 3	8- 8	9- 2	9- 7	9- 9½	10- 1
45	7- 1	7- 6	8- 5½	8-10½	9- 4½	9-10½	10- 0	10- 3½
46	7- 2½	7- 8	8- 7½	9- 1½	9- 7	10- 1	10- 2½	10- 6½
47	7- 4½	7-10	8- 9½	9- 3½	9- 9	10- 3½	10- 5½	10- 9½
48	7- 6	8- 0	9- 0	9- 6	10- 0	10- 6	10- 8	11- 0
49	7- 7½	8- 2	9- 2½	9- 8½	10- 2½	10- 8½	10-10½	11- 2½
50	7- 9½	8- 4	9- 4½	9-10½	10- 5	10-11½	11- 1½	11- 5½
51	7-11½	8- 6	9- 6½	10- 1½	10- 7½	11- 1½	11- 4	11- 8½
52	8- 1½	8- 8	9- 9	10- 3½	10-10	11- 4½	11- 6½	11-11
53	8- 3½	8-10	9-11½	10- 5½	11- 1	11- 7½	11- 9½	12- 1½
54	8- 5½	9- 0	10- 1½	10- 6½	11- 3	11- 9½	12- 0	12- 4½
55	8- 7½	9- 2	10- 3½	10-10½	11- 5½	12- 1	12- 2½	12- 7½
56	8- 9	9- 4	10- 6	11- 1	11- 6	12- 3	12- 5½	12-10
57	8-10½	9- 6	10- 8½	11- 3½	11-10½	12- 5½	12- 8	13- 1
58	9- 1½	9- 8	10-10½	11- 5½	12- 1	12- 8½	12-10½	13- 3½
59	9- 2½	9-10	11- 1½	11- 8½	12- 3½	12-10½	13- 1½	13- 6½
60	9- 4½	10- 0	11- 3	11-10½	12- 6	13- 1½	13- 4	13- 9
61	9- 6½	10- 2	11- 5½	12- 1½	12- 8½	13- 4½	13- 6½	13-11½
62	9- 8½	10- 4	11- 7½	12- 3½	12-11	13- 6½	13- 9½	14- 2½
63	9-10½	10- 6	11- 9½	12- 5½	13- 1½	13- 9½	14- 0	14- 5½
64	10- 0	10- 8	12- 0	12- 8	13- 4	14- 0	14- 2½	14- 8
65	10- 1½	10-10	12- 2½	12-10½	13- 6½	14- 2½	14- 5½	14-10½
66	10- 3½	11- 0	12- 4½	13- 0½	13- 9	14- 5½	14- 8	15- 1½
67	10- 5½	11- 2	12- 6½	13- 3½	13-11½	14- 7½	14-10½	15- 4½
68	10- 7½	11- 4	12- 9	13- 5½	14- 2	14-10½	15- 1	15- 7
69	10- 9½	11- 6	12-11½	13- 7½	14- 4½	15- 1	15- 4	15- 9½
70	10-11½	11- 8	13- 1½	13-10½	14- 7	15- 3½	15- 6½	16- 1

4.5 BRICK COURSING—VERTICAL (Cont.)

Course No.	Height of brick plus joint							
	1½ in.	2 in.	2½ in.	2¾ in.	3 in.	3½ in.	3¾ in.	4 in.
	Vertical height, ft.-in.							
71	11- 1½	11-10	13- 3½	14- ½	14- 9½	15- 6½	15- 9½	16- 3½
72	11- 3	12- 0	13- 6	14- 3	15- 0	15- 9	16- 0	16- 6
73	11- 4½	12- 2	13- 8½	14- 5½	15- 2½	15-11½	16- 2½	16- 8½
74	11- 6½	12- 4	13-10½	14- 7½	15- 5	16- 2½	16- 5½	16-11½
75	11- 8½	12- 6	14- ½	14-10½	15- 7½	16- 4½	16- 8	17- 2½
76	11-10½	12- 8	14- 3	15- ½	15-10	16- 7½	16-10½	17- 5
77	12- ½	12-10	14- 5½	15- 2½	16- ½	16-10½	17- 1½	17- 7½
78	12- 2½	13- 0	14- 7½	15- 5½	16- 3	17- ½	17- 4	17-10½
79	12- 4½	13- 2	14- 9½	15- 7½	16- 5½	17- 3½	17- 6½	18- 1½
80	12- 6	13- 4	15- 0	15-10	16- 8	17- 6	17- 9½	18- 4
81	12- 7½	13- 6	15- 2½	16- ½	16-10½	17- 8½	18- 0	18- 8½
82	12- 9½	13- 8	15- 4½	16- 2½	17- 1	17-11½	18- 2½	18- 9½
83	12-11½	13-10	15- 6½	16- 5½	17- 3½	18- 1½	18- 5½	19- ½
84	13- 1½	14- 0	15- 9	16- 7½	17- 6	18- 4½	18- 8	19- 3
85	13- 3½	14- 2	15-11½	16- 9½	17- 8½	18- 7½	18-10½	19- 5½
86	13- 5½	14- 4	16- 1½	17- 0½	17-11	18- 9½	19- 1½	19- 8½
87	13- 7½	14- 6	16- 3½	17- 2½	18- 1½	19- ½	19- 4	19-11½
88	13- 9	14- 8	16- 6	17- 5	18- 4	19- 3	19- 6½	20- 2
89	13-10½	14-10	16- 8½	17- 7½	18- 6½	19- 5½	19- 9½	20- 4½
90	14- ½	15- 0	16-10½	17- 9½	18- 9	19- 8½	20- 0	20- 7½
91	14- 2½	15- 2	17- ½	18- ½	18-11½	19-10½	20- 2½	20-10½
92	14- 4½	15- 4	17- 3	18- 2½	19- 2	20- 1½	20- 5½	21- 1
93	14- 6½	15- 6	17- 5½	18- 4½	19- 4½	20- 4½	20- 8	21- 3½
94	14- 8½	15- 8	17- 7½	18- 7½	19- 7	20- 6½	20-10½	21- 6½
95	14-10½	15-10	17- 9½	18- 9½	19- 9½	20- 9½	21- 1½	21- 9½
96	15- 0	16- 0	18- 0	19- 0	20- 0	21- 0	21- 4	22- 0
97	15- 1½	16- 2	18- 2½	19- 2½	20- 2½	21- 2½	21- 6½	22- 2½
98	15- 3½	16- 4	18- 4½	19- 4½	20- 5	21- 5½	21- 9½	22- 5½
99	15- 5½	16- 6	18- 6½	19- 7½	20- 7½	21- 7½	22- 0	22- 8½
100	15- 7½	16- 8	18- 9	19- 9½	20-10	21-10½	22- 2½	22-11
101	15- 9½	16-10	18-11½	19-11½	21- ½	22- 1½	22- 5½	23- 1½
102	15-11½	17- 0	19- 1½	20- 2½	21- 3	22- 3½	22- 8	23- 4½
103	16- 1½	17- 2	19- 3½	20- 4½	21- 5½	22- 6½	22-10½	23- 7½
104	16- 3	17- 4	19- 6	20- 7	21- 8	22- 9	23- 1½	23-10
105	16- 4½	17- 6	19- 8½	20- 9½	21-10½	22-11½	23- 4	24- ½

4.5 BRICK COURSING—VERTICAL (Cont.)

Course No.	Height of brick plus joint							
	1½ in.	2 in.	2½ in.	2½ in.	2½ in.	2½ in.	2½ in.	2½ in.
	Vertical height, ft.-in.							
106	16- 6½	17- 8	19-10½	20-11½	22- 1	23- 2½	23- 6½	24- 3½
107	16- 8½	17-10	20- ½	21- 2½	22- 3½	23- 4½	23- 9½	24- 6½
108	16-10½	18- 0	20- 3	21- 4½	22- 6	23- 7½	24- 0	24- 9
109	17- ½	18- 2	20- 5½	21- 6½	22- 8½	23-10½	24- 2½	24-11½
110	17- 2½	18- 4	20- 7½	21- 9½	22-11	24- ½	24- 5½	25- 2½
111	17- 4½	18- 6	20- 9½	21-11½	23- 1½	24- 3½	24- 8	25- 5½
112	17- 6	18- 8	21- 0	22- 2	23- 4	24- 6	24-10½	25- 8
113	17- 7½	18-10	21- 2½	22- 4½	23- 6½	24- 8½	25- 1½	25-10½
114	17- 9½	19- 0	21- 4½	22- 6½	23- 9	24-11½	25- 4	26- 1½
115	17-11½	19- 2	21- 6½	22- 9½	23-11½	25- 1½	25- 6½	26- 4½
116	18- 1½	19- 4	21- 9	22-11½	24- 2	25- 4½	25- 9½	26- 7
117	18- 3½	19- 6	21-11½	23- 1½	24- 4½	25- 7½	26- 0	26- 9½
118	18- 5½	19- 8	22- 1½	23- 4½	24- 7	25- 9½	26- 2½	27- ½
119	18- 7½	19-10	22- 3½	23- 6½	24- 9½	26- ½	26- 5½	27- 3½
120	18- 9	20- 0	22- 6	23- 9	25- 0	26- 3	26- 8	27- 6

4.6 FACING TILE COURSING—VERTICAL

Course No.	Height of block plus joint					
	4 in.	4½ in.	5½ in.	5½ in.	5½ in.	5½ in.
	Vertical height, ft.-in.					
1	0-4	0- 4½	0- 5½	0- 5½	0- 5½	0- 5½
2	0-8	0- 8½	0-10½	0-10½	0-10½	0-11
3	1-0	1- ¾	1- 3½	1- 4	1- 4½	1- 4½
4	1-4	1- 4½	1- 9	1- 9½	1- 9½	1-10
5	1-8	1- 8½	2- 2½	2- 2½	2- 2½	2- 3½
6	2-0	2- ¾	2- 7½	2- 8	2- 8½	2- 9
7	2-4	2- 4½	3- ¾	3- 1½	3- 1½	3- 2½
8	2-8	2- 9	3- 6	3- 6½	3- 7	3- 8
9	3-0	3- 1½	3-11½	4- 0	4- ½	4- 1½
10	3-4	3- 5½	4- 4½	4- 5½	4- 5½	4- 7
11	3-8	3- 9½	4- 9½	4-10½	4-11½	5- ½
12	4-0	4- 1½	5- 3	5- 4	5- 4½	5- 6
13	4-4	4- 5½	5- 8½	5- 9½	5- 9½	5-11½
14	4-8	4- 9½	6- 1½	6- 2½	6- 3½	6- 5
15	5-0	5- 1½	6- 6½	6- 8	6- 8½	6-10½
16	5-4	5- 6	7- 0	7- 1½	7- 2	7- 4
17	5-8	5-10½	7- 5½	7- 6½	7- 7½	7- 9½
18	6-0	6- 2½	7-10½	8- 0	8- ½	8- 3
19	6-4	6- 6½	8- 3½	8- 5½	8- 6½	8- 8½
20	6-8	6-10½	8- 9	8-10½	8-11½	9- 2
21	7-0	7- 2½	9- 2½	9- 4	9- 4½	9- 7½
22	7-4	7- 6½	9- 7½	9- 9½	9-10½	10- 1
23	7-8	7-10½	10- ¾	10- 2½	10- 3½	10- 6½
24	8-0	8- 3	10- 6	10- 8	10- 9	11- 0
25	8-4	8- 7½	10-11½	11- 1½	11- 2½	11- 5½
26	8-8	8-11½	11- 4½	11- 6½	11- 7½	11-11
27	9-0	9- 3½	11- 9½	12- 0	12- 1½	12- 4½
28	9-4	9- 7½	12- 3	12- 5½	12- 6½	12-10
29	9-8	9-11½	12- 8½	12-10½	12-11½	13- 3½
30	10-0	10- 3½	13- 1½	13- 4	13- 5½	13- 9
31	10-4	10- 7½	13- 6½	13- 9½	13-10½	14- 2½
32	10-8	11- 0	14- 0	14- 2½	14- 4	14- 8
33	11-0	11- 4½	14- 5½	14- 8	14- 9½	15- 1½
34	11-4	11- 8½	14-10½	15- 1½	15- 2½	15- 7
35	11-8	12- ½	15- 3½	15- 6½	15- 8½	16- ½

4.6 FACING TILE COURSING—VERTICAL (Cont.)

Course No.	Height of block plus joint					
	4 in.	4½ in.	5½ in.	5½ in.	5½ in.	5½ in.
	Vertical height, ft.-in.					
36	12-0	12- 4½	15- 9	16- 0	16- 1½	16- 6
37	12-4	12- 8½	16- 2½	16- 5½	16- 6½	16-11½
38	12-8	13- ½	16- 7½	16-10½	17- ½	17- 5
39	13-0	13- 4½	17- ½	17- 4	17- 5½	17-10½
40	13-4	13- 9	17- 6	17- 9½	17-11	18- 4
41	13-8	14- 1½	17-11½	18- 2½	18- 4½	18- 9½
42	14-0	14- 5½	18- 4½	18- 8	18- 9½	19- 3
43	14-4	14- 9½	18- 9½	19- 1½	19- 3½	19- 8½
44	14-8	15- 1½	19- 3	19- 6½	19- 8½	20- 2
45	15-0	15- 5½	19- 8½	20- 0	20- 1½	20- 7½
46	15-4	15- 9½	20- 1½	20- 5½	20- 7½	21- 1
47	15-8	16- 1½	20- 6½	20-10½	21- ½	21- 6½
48	16-0	16- 6	21- 0	21- 4	21- 6	22- 0
49	16-4	16-10½	21- 5½	21- 9½	21-11½	22- 5½
50	16-8	17- 2½	21-10½	22- 2½	22- 4½	22-11
51	17-0	17- 6½	22- 3½	22- 8	22-10½	23- 4½
52	17-4	17-10½	22- 9	23- 1½	23- 3½	23-10
53	17-8	18- 2½	23- 2½	23- 6½	23- 8½	24- 3½
54	18-0	18- 6½	23- 7½	24- 0	24- 2½	24- 9
55	18-4	18-10½	24- ½	24- 5½	24- 7½	25- 2½
56	18-8	19- 3	24- 6	24-10½	25- 1	25- 8
57	19-0	19- 7½	24-11½	25- 4	25- 6½	26- 1½
58	19-4	19-11½	25- 4½	25- 9½	25-11½	26- 7
59	19-8	20- 3½	25- 9½	26- 2½	26- 5½	27- ½
60	20-0	20- 7½	26- 3	26- 8	26-10½	27- 6

4.7 CINDER BLOCK COURSING—VERTICAL

Course No.	Height of block plus joint						
	7½ in.	7¾ in.	7⅞ in.	7⅞ in.	8 in.	8½ in.	8⅞ in.
	Vertical height, ft.-in.						
1	0- 7½	0- 7¾	0- 7⅞	0- 7⅞	0-8	0- 8½	0- 8⅞
2	1- 3	1- 3¼	1- 3½	1- 3½	1-4	1- 4½	1- 4¾
3	1-10½	1-11½	1-11½	1-11½	2-0	2- ½	2- ¾
4	2- 6	2- 6½	2- 7	2- 7½	2-8	2- 8½	2- 9
5	3- 1½	3- 2½	3- 2½	3- 3½	3-4	3- 4½	3- 5½
6	3- 9	3- 9½	3-10½	3-11½	4-0	4- ½	4- 1½
7	4- 4½	4- 5½	4- 6½	4- 7½	4-8	4- 8½	4- 9½
8	5- 0	5- 1	5- 2	5- 3	5-4	5- 5	5- 6
9	5- 7½	5- 8½	5- 9½	5-10½	6-0	6- 1½	6- 2½
10	6- 3	6- 4½	6- 5½	6- 6½	6-8	6- 9½	6-10½
11	6-10½	6-11½	7- 1½	7- 2½	7-4	7- 5½	7- 6½
12	7- 6	7- 7½	7- 9	7-10½	8-0	8- 1½	8- 3
13	8- 1½	8- 3½	8- 4½	8- 6½	8-8	8- 9½	8-11½
14	8- 9	8-10½	9- ½	9- 2½	9-4	9- 5½	9- 7½
15	9- 4½	9- 6½	9- 8½	9-10½	10-0	10- 1½	10- 3½
16	10- 0	10- 2	10- 4	10- 6	10-8	10-10	11- 0
17	10- 7½	10- 9½	10-11½	11- 1½	11-4	11- 6½	11- 8½
18	11- 3	11- 5½	11- 7½	11- 9½	12-0	12- 2½	12- 4½
19	11-10½	12- ½	12- 3½	12- 5½	12-8	12-10½	13- ½
20	12- 6	12- 8½	12-11	13- 1½	13-4	13- 6½	13- 9
21	13- 1½	13- 4½	13- 6½	13- 9½	14-0	14- 2½	14- 5½
22	13- 9	13-11½	14- 2½	14- 5½	14-8	14-10½	15- 1½
23	14- 4½	14- 7½	14-10½	15- 1½	15-4	15- 6½	15- 9½
24	15- 0	15- 3	15- 6	15- 9	16-0	16- 3	16- 6
25	15- 7½	15-10½	16- 1½	16- 4½	16-8	16-11½	17- 2½
26	16- 3	16- 6½	16- 9½	17- ½	17-4	17- 7½	17-10½
27	16-10½	17- 1½	17- 5½	17- 8½	18-0	18- 3½	18- 6½
28	17- 6	17- 9½	18- 1	18- 4½	18-8	18-11½	19- 3
29	18- 1½	18- 5½	18- 8½	19- ½	19-4	19- 7½	19-11½
30	18- 9	19- ½	19- 4½	19- 8½	20-0	20- 3½	20- 7½
31	19- 4½	19- 8½	20- ½	20- 4½	20-8	20-11½	21- 3½
32	20- 0	20- 4	20- 8	21- 0	21-4	21- 8	22- 0
33	20- 7½	20-11½	21- 3½	21- 7½	22-0	22- 4½	22- 8½
34	21- 3	21- 7½	21-11½	22- 3½	22-8	23- ½	23- 4½
35	21-10½	22- 2½	22- 7½	22-11½	23-4	23- 8½	24- ½

4.7 CINDER BLOCK COURSING—VERTICAL (Cont.)

Course No.	Height of block plus joint						
	7½ in.	7½ in.	7½ in.	7½ in.	8 in.	8½ in.	8½ in.
	Vertical height, ft.-in.						
36	22- 6	22-10½	23- 3	23- 7½	24-0	24- 4½	24- 9
37	23- 1½	23- 6½	23-10½	24- 3½	24-6	25- ½	25- 5½
38	23- 9	24- 1½	24- 6½	24-11½	25-4	25- 8½	26- 1½
39	24- 4½	24- 9½	25- 2½	25- 7½	26-0	26- 4½	26- 9½
40	25- 0	25- 5	25-10	26- 3	26-8	27- 1	27- 6
41	25- 7½	26- ½	26- 5½	26-10½	27-4	27- 9½	28- 2½
42	26- 3	26- 8½	27- 1½	27- 6½	28-0	28- 5½	28-10½
43	26-10½	27- 3½	27- 9½	28- 2½	28-8	29- 1½	29- 6½
44	27- 6	27-11½	28- 5	28-10½	29-4	29- 9½	30- 3
45	28- 1½	28- 7½	29- ½	29- 6½	30-0	30- 5½	30-11½
46	28- 9	29- 2½	29- 8½	30- 2½	30-8	31- 1½	31- 7½
47	29- 4½	29-10½	30- 4½	30-10½	31-4	31- 9½	32- 3½
48	30- 0	30- 6	31- 0	31- 6	32-0	32- 6	33- 0
49	30- 7½	31- 1½	31- 7½	32- 1½	32-8	33- 2½	33- 8½
50	31- 3	31- 9½	32- 3½	32- 9½	33-4	33-10½	34- 4½
51	31-10½	32- 4½	32-11½	33- 5½	34-0	34- 6½	35- ½
52	32- 6	33- ½	33- 7	34- 1½	34-8	35- 2½	35- 9
53	33- 1½	33- 8½	34- 2½	34- 9½	35-4	35-10½	36- 5½
54	33- 9	34- 3½	34-10½	35- 5½	36-0	36- 6½	37- 1½
55	34- 4½	34-11½	35- 6½	36- 1½	36-8	37- 2½	37- 9½
56	35- 0	35- 7	36- 2	36- 9	37-4	37-11	38- 6
57	35- 7½	36- 2½	36- 9½	37- 4½	38-0	38- 7½	39- 2½
58	36- 3	36-10½	37- 5½	38- ½	38-8	39- 3½	39-10½
59	36-10½	37- 5½	38- 1½	38- 8½	39-4	39-11½	40- 6½
60	37- 6	38- 1½	38- 9	39- 4½	40-0	40- 7½	41- 3

4.8 MASONRY LAYOUT—HORIZONTAL (8- and 12-in. units)

For wall dimensions, deduct one joint from the length given. For openings, add one joint to length given.

No. of pieces	Length of unit plus joint						
	7½ in.	8 in.	8½ in.	8¾ in.	11½ in.	12 in.	12½ in.
	Horizontal length, ft.-in.						
1	0- 7½	0-8	0- 8½	0- 8¾	0-11½	1-0	1- ½
2	1- 3½	1-4	1- 4½	1- 4¾	1-11½	2-0	2- ½
3	1-11½	2-0	2- ½	2- ¾	2-11½	3-0	3- ½
4	2- 7½	2-8	2- 8½	2- 9	3-11½	4-0	4- ½
5	3- 3½	3-4	3- 4½	3- 5¾	4-11½	5-0	5- ½
6	3-11½	4-0	4- ½	4- ¾	5-11½	6-0	6- ½
7	4- 7½	4-8	4- 8½	4- 9¾	6-11½	7-0	7- ½
8	5- 3	5-4	5- 5	5- 6	7-11	8-0	8- 1
9	5-10½	6-0	6- 1½	6- 2½	8-10½	9-0	9- 1½
10	6- 6½	6-8	6- 9½	6-10½	9-10½	10-0	10- 1½
11	7- 2½	7-4	7- 5½	7- 6½	10-10½	11-0	11- 1½
12	7-10½	8-0	8- 1½	8- 3	11-10½	12-0	12- 1½
13	8- 6½	8-8	8- 9½	8-11½	12-10½	13-0	13- 1½
14	9- 2½	9-4	9- 5½	9- 7½	13-10½	14-0	14- 1½
15	9-10½	10-0	10- 1½	10- 3½	14-10½	15-0	15- 1½
16	10- 6	10-8	10-10	11- 0	15-10	16-0	16- 2
17	11- 1½	11-4	11- 6½	11- 8½	16- 9½	17-0	17- 2½
18	11- 9½	12-0	12- 2½	12- 4½	17- 9½	18-0	18- 2½
19	12- 5½	12-8	12-10½	13- ¾	18- 9½	19-0	19- 2½
20	13- 1½	13-4	13- 6½	13- 9	19- 9½	20-0	20- 2½
21	13- 9½	14-0	14- 2½	14- 5½	20- 9½	21-0	21- 2½
22	14- 5½	14-8	14-10½	15- 1½	21- 9½	22-0	22- 2½
23	15- 1½	15-4	15- 6½	15- 9½	22- 9	23-0	23- 2½
24	15- 9	16-0	16- 3	16- 6	23- 9	24-0	24- 3
25	16- 4½	16-8	16-11½	17- 2½	24- 8½	25-0	25- 3½
26	17- ¾	17-4	17- 7½	17-10½	25- 8½	26-0	26- 3½
27	17- 8½	18-0	18- 3½	18- 6½	26- 8½	27-0	27- 3½
28	18- 4½	18-8	18-11½	19- 3	27- 8½	28-0	28- 3½
29	19- ¾	19-4	19- 7½	19-11½	28- 8½	29-0	29- 3½
30	19- 8½	20-0	20- 3½	20- 7½	29- 8½	30-0	30- 3½
31	20- 4½	20-8	20-11½	21- 3½	30- 8½	31-0	31- 3½
32	21- 0	21-4	21- 8	22- 0	31- 7	32-0	32- 4
33	21- 7½	22-0	22- 4½	22- 8½	32- 7½	33-0	33- 4½
34	22- 3½	22-8	23- ½	23- 4½	33- 7½	34-0	34- 4½
35	22-11½	23-4	23- 8½	24- ½	34- 7½	35-0	35- 4½

4.8 MASONRY LAYOUT—HORIZONTAL (8- and 12-in. units) (Cont.)

No. of pieces	Length of unit plus joint						
	7½ in.	8 in.	8½ in.	8¾ in.	11½ in.	12 in.	12½ in.
	Horizontal length, ft.-in.						
36	23- 7½	24-0	24- 4½	24- 9	35- 7½	36-0	36- 4½
37	24- 3½	24-8	25- ½	25- 5½	36- 7½	37-0	37- 4½
38	24-11½	25-4	25- 8½	26- 1½	37- 7½	38-0	38- 4½
39	25- 7½	26-0	26- 4½	26- 9½	38- 7½	39-0	39- 4½
40	26- 3	26-8	27- 1	27- 6	39- 6	40-0	40- 5
41	26-10½	27-4	27- 9½	28- 2½	40- 8½	41-0	41- 5½
42	27- 6½	28-0	28- 5½	28-10½	41- 6½	42-0	42- 5½
43	28- 2½	28-8	29- 1½	29- 6½	42- 6½	43-0	43- 5½
44	28-10½	29-4	29- 9½	30- 3	43- 6½	44-0	44- 5½
45	29- 6½	30-0	30- 5½	30-11½	44- 6½	45-0	45- 5½
46	30- 2½	30-8	31- 1½	31- 7½	45- 6½	46-0	46- 5½
47	30-10½	31-4	31- 9½	32- 3½	46- 8½	47-0	47- 5½
48	31- 6	32-0	32- 6	33- 0	47- 5	48-0	48- 6
49	32- 1½	32-8	33- 2½	33- 8½	48- 5½	49-0	49- 6½
50	32- 9½	33-4	33-10½	34- 4½	49- 5½	50-0	50- 6½
51	33- 5½	34-0	34- 6½	35- ½	50- 5½	51-0	51- 6½
52	34- 1½	34-8	35- 2½	35- 9	51- 5½	52-0	52- 6½
53	34- 9½	35-4	35-10½	36- 5½	52- 5½	53-0	53- 6½
54	35- 5½	36-0	36- 6½	37- 1½	53- 5½	54-0	54- 6½
55	36- 1½	36-8	37- 2½	37- 9½	54- 5½	55-0	55- 6½
56	36- 9	37-4	37-11	38- 6	55- 4	56-0	56- 7
57	37- 4½	38-0	38- 7½	39- 2½	56- 4½	57-0	57- 7½
58	38- ½	38-8	39- 3½	39-10½	57- 4½	58-0	58- 7½
59	38- 8½	39-4	39-11½	40- 6½	58- 4½	59-0	59- 7½
60	39- 4½	40-0	40- 7½	41- 3	59- 4½	60-0	60- 7½

4.9 MASONRY LAYOUT—HORIZONTAL (16- and 18-in. units)

No. of pieces	Length of block plus joint					
	16 in.	16½ in.	16¾ in.	18 in.	18½ in.	18¾ in.
	Horizontal length, ft.-in.					
1	1-4	1- 4½	1- 4¾	1-6	1- 6½	1- 6¾
2	2-8	2- 8½	2- 8¾	3-0	3- ½	3- ¾
3	4-0	4- ½	4- ¾	4-6	4- 6½	4- 6¾
4	5-4	5- 4½	5- 5	6-0	6- ½	6- 1
5	6-8	6- 8½	6- 9¼	7-6	7- 6½	7- 7¼
6	8-0	8- ¾	8- 1½	9-0	9- ¾	9- 1½
7	9-4	9- 4½	9- 5½	10-6	10- 6½	10- 7½
8	10-8	10- 9	10-10	12-0	12- 1	12- 2
9	12-0	12- 1½	12- 2½	13-6	13- 7½	13- 8½
10	13-4	13- 5½	13- 6½	15-0	15- 1½	15- 2½
11	14-8	14- 9½	14-10½	16-6	16- 7½	16- 8½
12	16-0	16- 1½	16- 3	18-0	18- 1½	18- 3
13	17-4	17- 5½	17- 7½	19-6	19- 7½	19- 9½
14	18-8	18- 9½	18-11½	21-0	21- 1½	21- 3½
15	20-0	20- 1½	20- 3½	22-6	22- 7½	22- 9½
16	21-4	21- 6	21- 8	24-0	24- 2	24- 4
17	22-8	22-10½	23- ¼	25-6	25- 8½	25-10½
18	24-0	24- 2½	24- 4½	27-0	27- 2½	27- 4½
19	25-4	25- 6½	25- 8½	28-6	28- 8½	28-10½
20	26-8	26-10½	27- 1	30-0	30- 2½	30- 5
21	28-0	28- 2½	28- 5½	31-6	31- 8½	31-11½
22	29-4	29- 6½	29- 9½	33-0	33- 2½	33- 5½
23	30-8	30-10½	31- 1½	34-6	34- 8½	34-11½
24	32-0	32- 3	32- 6	36-0	36- 3	36- 6
25	33-4	33- 7½	33-10½	37-6	37- 9½	38- ¼
26	34-8	34-11½	35- 2½	39-0	39- 3½	39- 6½
27	36-0	36- 3½	36- 6½	40-6	40- 9½	41- ¼
28	37-4	37- 7½	37-11	42-0	42- 3½	42- 7
29	38-8	38-11½	39- 3½	43-6	43- 9½	44- 1½
30	40-0	40- 3½	40- 7½	45-0	45- 3½	45- 7½
31	41-4	41- 7½	41-11½	46-6	46- 9½	47- 1½
32	42-8	43- 0	43- 4	48-0	48- 4	48- 8
33	44-0	44- 4½	44- 8½	49-6	49-10½	50- 2½
34	45-4	45- 8½	46- ½	51-0	51- 4½	51- 8½
35	46-8	47- ½	47- 4½	52-6	52-10½	53- 2½

4.9 MASONRY LAYOUT—HORIZONTAL (16- and 18-in. units) (Cont.)

No. of pieces	Length of block plus joint					
	16 in.	16½ in.	16¾ in.	18 in.	18½ in.	18¾ in.
	Horizontal length, ft.-in.					
36	48-0	48- 4½	48- 9	54-0	54- 4½	54- 9
37	49-4	49- 8½	50- 1½	55-6	55-10½	56- 3½
38	50-8	51- ¼	51- 5½	57-0	57- 4½	57- 9½
39	52-0	52- 4½	52- 9½	58-6	58-10½	59- 3½
40	53-4	53- 9	54- 2	60-0	60- 5	60-10
41	54-8	55- 1½	55- 6½	61-6	61-11½	62- 4½
42	56-0	56- 5½	56-10½	63-0	63- 5½	63-10½
43	57-4	57- 9½	58- 2½	64-6	64-11½	65- 4½
44	58-8	59- 1½	59- 7	66-0	66- 5½	66-11
45	60-0	60- 5½	60-11½	67-6	67-11½	68- 5½
46	61-4	61- 9½	62- 3½	69-0	69- 5½	69-11½
47	62-8	63- 1½	63- 7½	70-6	70-11½	71- 5½
48	64-0	64- 6	65- 0	72-0	72- 6	73- 0
49	65-4	65-10½	66- 4½	73-6	74- ½	74- 6½
50	66-8	67- 2½	67- 8½	75-0	75- 6½	76- ½
51	68-0	68- 6½	69- ¼	76-6	77- ¾	77- 6½
52	69-4	69-10½	70- 5	78-0	78- 6½	79- 1
53	70-8	71- 2½	71- 9½	79-6	80- ¾	80- 7½
54	72-0	72- 6½	73- 1½	81-0	81- 6½	82- 1½
55	73-4	73-10½	74- 5½	82-6	83- ½	83- 7½
56	74-8	75- 3	75-10	84-0	84- 7	85- 2
57	76-0	76- 7½	77- 2½	85-6	86- 1½	86- 8½
58	77-4	77-11½	78- 6½	87-0	87- 7½	88- 2½
59	78-8	79- 3½	79-10½	88-6	89- 1½	89- 8½
60	80-0	80- 7½	81- 3	90-0	90- 7½	91- 3

4.10 CLAY TILE AND GYPSUM TILE

Clay Partition Tile

Tile size, in.	Tile plus joint, in. (height × length)	No. of pieces per sq ft
$11\frac{1}{2} \times 11\frac{1}{2}$	$11\frac{1}{2} \times 11\frac{1}{2}$	1.09
$11\frac{1}{2} \times 11\frac{1}{2}$	12×12	1.00
$11\frac{1}{2} \times 11\frac{1}{2}$	$12\frac{1}{2} \times 12\frac{1}{2}$	0.98
12×12	$12\frac{1}{2} \times 12\frac{1}{2}$	0.94
12×12	$12\frac{1}{2} \times 12\frac{1}{2}$	0.92
12×12	$12\frac{1}{2} \times 12\frac{1}{2}$	0.90

Clay Speed-A-Backer Tile

Tile size, in.	Tile plus joint, in. (height × length)	No. of pieces per sq ft
$7\frac{1}{2} \times 12$ (for $2\frac{1}{2}$ " brick coursing)	$7\frac{1}{2} \times 12\frac{1}{2}$	1.46
$7\frac{1}{2} \times 7\frac{1}{2}$ (for $2\frac{1}{2}$ " brick coursing)	$7\frac{1}{2} \times 8\frac{1}{2}$	2.22
$7\frac{1}{2} \times 12$ (for $2\frac{1}{2}$ " brick coursing)	$8\frac{1}{2} \times 12\frac{1}{2}$	1.39
$7\frac{1}{2} \times 7\frac{1}{2}$ (for $2\frac{1}{2}$ " brick coursing)	$8\frac{1}{2} \times 8\frac{1}{2}$	2.12

Gypsum Tile

Tile size, in.	Tile plus joint, in. (height × length)	No. of pieces per sq ft
12×30	12×30	0.40
12×30	$12\frac{1}{2} \times 30\frac{1}{2}$	0.37
12×30	$12\frac{1}{2} \times 30\frac{1}{2}$	0.37

4.11 GLASS BLOCKS

Series	Size, in.	Coursing, in.	No. of pieces per sq ft
200	$5\frac{1}{4} \times 5\frac{1}{4}$	6 × 6	4.00
300	$7\frac{1}{4} \times 7\frac{1}{4}$	8 × 8	2.25
400	$11\frac{1}{4} \times 11\frac{1}{4}$	12 × 12	1.00

Coursing (Vertical) and Horizontal Layout

Courses	Block size		
	6 × 6 in.	8 × 8 in.	12 × 12 in.
	Height and length, ft.-in.		
1	0-6	0-8	1-0
2	1-0	1-4	2-0
3	1-6	2-0	3-0
4	2-0	2-8	4-0
5	2-6	3-4	5-0
6	3-0	4-0	6-0
7	3-6	4-8	7-0
8	4-0	5-4	8-0
9	4-6	6-0	9-0
10	5-0	6-8	10-0
11	5-6	7-4	11-0
12	6-0	8-0	12-0
13	6-6	8-8	13-0
14	7-0	9-4	14-0
15	7-6	10-0	15-0
16	8-0	10-8	16-0
17	8-6	11-4	17-0
18	9-0	12-0	18-0
19	9-6	12-8	19-0
20	10-0	13-4	20-0
21	10-6	14-0	21-0
22	11-0	14-8	22-0
23	11-6	15-4	23-0
24	12-0	16-0	24-0
25	12-6	16-8	25-0

4.12 MORTAR MIXERS

Cement-Lime Mortar

Proportions			Materials per cubic yard		
Cement	Lime	Sand	Cement, bags	Lime, bags	Sand, cu yd
1		1½	14.5		0.80
1		2	12.1		0.90
1		2½	10.5		0.95
1		3	9.2		1.00
1	0.25	3	8.2	2.0	1.00
1	1	4	6.5	6.5	1.00
1	1	5	5.3	5.3	1.00
1	1	6	4.5	4.5	1.00
1	2	9	3.0	6.0	1.00

Prepared Masonry Cement—Materials per Cubic Yard

Material	Proportions (masonry cement : sand)				
	1:2	1:2½	1:3	1:3½	1:4
Masonry cement, bags	12.25	10.00	8.50	7.50	6.50
Sand (at 85 lb/cu ft) cu yd	0.90	0.92	0.95	0.95	0.95
Masonry cement, bags	11.50	9.50	8.00	7.00	6.25
Sand (at 90 lb/cu ft) cu yd	0.85	0.90	0.90	0.90	0.90
Masonry cement, bags	11.00	9.00	7.75	6.50	6.00
Sand (at 95 lb/cu ft) cu yd	0.80	0.85	0.85	0.85	0.85

Masonry Units Laid per Bag of Cement

Masonry unit	Pieces laid with a 1:1:6 mix*	Pieces laid with a 1:3 mortar cement†
Brick	330	170
4" cinder block	110	60
8" cinder block	75	40
12" cinder block	60	35
4" facing tile 5 × 8	75	40
4" facing tile 5 × 12	95	55

*One bag of cement, one bag of lime, and 6 cu ft of sand.

†One bag of mortar cement and 3 cu ft of sand.

4.13 MORTAR QUANTITIES

The quantities given are for the average job, waste and spillage included.

Masonry material	Joints, in.	Mortar, cu ft
Brick:		
Standard size (face or common)	1	16 per 1,000 pieces
		18
		20
Norman size		14
		16
Roman size		19
		21
Cinder block (8" × 16")	4	5 per 100 pieces
	6	6
	8	8
	10	9
	12	10
Clay tile partition block (12" × 12")	4	4 per 100 pieces
	6	5
	8	6
	12	7
Glazed facing tile (5" × 8")	2	5 per 100 sq ft
	4	8
Glazed facing tile (5" × 12")	2	4 per 100 sq ft
	4	6
Gypsum tile partitions	3	3 per 100 sq ft
	4	4
	6	5

Fire brick:

Thin joint: 350 lb fireclay per 1,000 pieces

Medium joint: 550 lb fireclay per 1,000 pieces

4.14 FIRE BRICK AND FLUE LININGS

Fire Brick ($4\frac{1}{2}$ " thick)	No. of Pieces per Sq Ft
9" × 2" (thin joint)	7.5
9" × 2" (medium joint)	7.0
9" × $2\frac{1}{2}$ " (thin joint)	6.0
9" × $2\frac{1}{2}$ " (medium joint)	5.6

Fireclay Flue Linings—Modular Sizes

Normal size, in.	Actual outside dimensions, in.	Thickness of wall, in.
4 × 8	$3\frac{1}{2} \times 7\frac{1}{2}$	$\frac{1}{2}$
4 × 12	$3\frac{1}{2} \times 11\frac{1}{2}$	$\frac{1}{2}$
4 × 16	$3\frac{1}{2} \times 15\frac{1}{2}$	$\frac{1}{2}$
8 × 8*	$7\frac{1}{2} \times 7\frac{1}{2}$	$\frac{1}{2}$
8 × 12*	$7\frac{1}{2} \times 11\frac{1}{2}$	$\frac{1}{2}$
8 × 16	$7\frac{1}{2} \times 15\frac{1}{2}$	$\frac{1}{2}$
12 × 12*	$11\frac{1}{2} \times 11\frac{1}{2}$	$\frac{3}{4}$
12 × 16	$11\frac{1}{2} \times 15\frac{1}{2}$	1
16 × 16	$15\frac{1}{2} \times 15\frac{1}{2}$	$1\frac{1}{2}$
16 × 20	$15\frac{1}{2} \times 19\frac{1}{2}$	$1\frac{1}{2}$
20 × 20	$19\frac{1}{2} \times 19\frac{1}{2}$	$1\frac{3}{4}$
20 × 24	$19\frac{1}{2} \times 23\frac{1}{2}$	$1\frac{3}{4}$
24 × 24	$23\frac{1}{2} \times 23\frac{1}{2}$	$1\frac{3}{4}$

All sizes are supplied in 2-ft lengths.

*Stock manufactured sizes; other modular sizes not normally stock items.

4.15 FIRE CLAY FLUE LININGS (A.S.T.M. C315-53T)

Rectangular

Outside dimensions, in.	Inside dimensions, in.	Weight per lin ft, lb
$4\frac{1}{2} \times 8\frac{1}{2}$	$3\frac{1}{2} \times 7\frac{1}{2}$	11
$8\frac{1}{2} \times 8\frac{1}{2}$	$7\frac{1}{2} \times 7\frac{1}{2}$	18
$8\frac{1}{2} \times 13$	$6\frac{1}{2} \times 11\frac{1}{2}$	27
$8\frac{1}{2} \times 18$	$6\frac{1}{2} \times 16$	36
13×13	$11\frac{1}{2} \times 11\frac{1}{2}$	35
13×18	$10\frac{1}{2} \times 15\frac{1}{2}$	45
18×18	$15\frac{1}{2} \times 15\frac{1}{2}$	70
20×20	17×17	103
20×24	17×21	115
24×24	21×21	129

All linings are supplied in 2-ft lengths.

Round

Inside dia., in.	Outside dia., in.	Weight per lin ft, lb
6*	$7\frac{1}{2}$	11
8*	$9\frac{1}{2}$	17
10*	$11\frac{1}{2}$	27
12*	14	37
15*	$17\frac{1}{2}$	52
18*	$20\frac{1}{2}$	67
21*	$24\frac{1}{2}$	90
24*	$27\frac{1}{2}$	120
27†	31	166
30†	$34\frac{1}{2}$	218
36†	41	330

*This lining is supplied in 2-ft lengths.

†This lining is supplied in 3-ft lengths.

4.16 FLAGSTONE AND ASHLAR STONE

Flagstone Paving

Material	Average thickness, in.	Sq ft per ton
Slate (sawn)	$\frac{1}{4}$ to $\frac{3}{8}$	420
	$\frac{1}{2}$	265
	$\frac{3}{4}$	180
	1	133
Slate (cleft)	$\frac{1}{2}$	250
	$\frac{3}{4}$	166
	1	125
Crab Orchard cleft	1	140
	2	70

Ashlar (Average $3\frac{1}{4}$ in. Thick) for Wall Veneer

Sandstone in $2\frac{1}{4}$ in. height (for 1 brick coursing):	55 sq ft per ton
Sandstone in 5 in. height (for 2 brick coursing):	47 sq ft per ton
Sandstone in $7\frac{1}{4}$ in. height (for 3 brick coursing):	40 sq ft per ton

SECTION V

Plaster

1

5.1 METAL STUD PLASTER PARTITIONS

Stud width, in.	Finish wall thickness, in.	Spacing of studs		
		16 in. c to c	19 in. c to c	24 in. c to c
		Maximum height, ft*		
2½	4	15	14	9
3½	4¾	21	18	13
4	5½	22	20	16
6	7½	26	24	20

*Reduce maximum height by 20 per cent when length exceeds one and one half times height.

Lath Requirements and Stud Spacings

Lath	Weight, lb per sq yd	Stud spacing required, in. c to c
Diamond mesh metal lath	2.5	12
	3.4	16
Flat rib metal lath	2.75	16
	3.4	19
Metal rib lath, ½ in.	3.4	24
	4.0	24
Gypsum lath, ½ in.		24
Gypsum lath, ¾ in.		16

5.2 EQUIPMENT FOR SUSPENDED CEILINGS

Hangers for Suspended Ceilings

The maximum spacing is 4 ft (16 sq ft per hanger). Alternative hanger material is #9 wire, #8 galvanized wire, ¾ in. steel rods, and 1 in. × ¾ in. flat steel bars.

Runners for Suspended Ceilings

Hanger spacing, ft-in.	Runner size, (channel, cold rolled), in.	Runner spacing, ft-in. c to c	Runner weight, lb per lin ft
Not over 3-0	1½	4-0	0.475
3-0 to 3-6	1¾	3-6	0.475
3-6 to 4-0	1¾	3-0	0.475

Cross Furring for Suspended Ceilings

<u>Runner Spacing, ft-in.</u>	<u>Cross Furring Spacing, in. c to c*</u>
3-0	24
3-6	19
4-0	16

*Using ¾ in. cold-rolled channel cross furring at 0.30 lb per lin ft.

5.3 PLASTERING QUANTITIES

3-Coat Gypsum Plaster (Job Mixed, per 100 sq yd— $\frac{3}{4}$ in.)

Surface	Scratch coat (1:2)		Brown coat (1:3)		Finishing coat (2:1)	
	Plaster, lb	Sand, lb	Plaster, lb	Sand, lb	Hydrated lime, lb	Gauging plaster, lb
Metal lath	750	1,500	1,100	3,300	350	175
Gypsum lath	400	800	700	2,100	350	175
Brick or block*	500	1,500	700	2,100	350	175
Gypsum tile	450	900	700	2,100	350	175

*Mix is 1:3.

2-Coat Gypsum Plaster (Job Mixed, per 100 sq yd— $\frac{1}{2}$ in.)

Surface	Brown coat (1:2 $\frac{1}{2}$)		Finishing coat (2:1)	
	Plaster, lb	Sand, lb	Hydrated lime, lb	Gauging plaster, lb
Metal lath	1,800	4,500	350	175
Gypsum lath	1,000	2,500	350	175
Brick or block*	1,150	2,900	350	175
Gypsum tile	1,100	2,750	350	175

Gypsum plaster weighs 100 lb per bag. Sand weighs 100 lb per cu ft.

*Mix is 1:3.

3-Coat Wood Fiber Plaster (per 100 sq yd— $\frac{3}{4}$ in.)

Surface	Scratch coat plaster, lb	Brown coat plaster, lb	Finish coat	
			Hydrated lime, lb	Gauging plaster, lb
Metal lath	1,100	2,300	350	175
Gypsum lath	600	1,200	350	175

Wood fiber plaster weighs 100 lb per bag.

5.3 PLASTERING QUANTITIES (Cont.)

3-Coat Vermiculite Plaster (per 100 sq yd— $\frac{3}{8}$ in.)

Surface	Scratch coat (1:2)		Brown coat (1:3)		Finishing coat (2:1)	
	Gypsum plaster, lb	Vermiculite, bags	Gypsum plaster, lb	Vermiculite, bags	Hydrated lime, lb	Gauging plaster, lb
Metal lath	1,000	20	1,200	36	350	175
Gypsum lath	550	11	650	19	350	175
Brick or block*	450	13	850	25	350	175

For perlite aggregate, use the same quantities. Vermiculite is 1 cu ft per bag.

*Mix is 1:3.

3-Coat Lime Putty Plaster (per 100 sq yd— $\frac{3}{8}$ in.)

Surface	Scratch coat (1:2)			Brown coat (1:3)			Finish coat	
	Lime putty, cu ft	Sand, lb	Fiber, lb	Lime putty, cu ft	Sand, lb	Fiber, lb	Hydrated lime, lb	Gauging plaster, lb
Metal lath	24	4,800	5	12	3,600	3	350	175
Brick or block*	$7\frac{1}{2}$	1,500	$1\frac{1}{2}$	10	3,000	2	350	175

For lime putty volume per ton of various materials, see page 153. Sand weighs 100 lb per cu ft.

*Mix is 1:3.

2-Coat Lime Putty Plaster (per 100 sq yd— $\frac{1}{2}$ in.)

Surface	Brown coat (1:3)			Finish coat	
	Lime putty, cu ft	Sand, lb	Fiber, lb	Hydrated lime, lb	Gauging plaster, lb
Brick or block	14	4,200	3	350	175

5.3 PLASTERING QUANTITIES (Cont.)

Keenes Cement Finish (per 100 sq yd)

Sand Float Finish

170 lb Keenes cement
130 lb hydrated lime
800 lb sand

Smooth Finish

550 lb Keenes cement
280 lb hydrated lime

3-Coat Portland Cement Plaster (per 100 sq yd— $\frac{3}{8}$ in.)

Surface	Scratch coat			Brown coat			Finish coat		
	1:3 (10% lime)			1:3 (10% lime)			1:3 (10% lime)		
	Cement, bags	Lime, lb	Sand, lb	Cement, bags	Lime, lb	Sand, lb	Cement, bags	Lime, lb	Sand, lb
Metal lath	7	70	2,100	11	110	3,300	4	40	1,200
Brick or block*	6	60	1,800	8	80	2,400	4	40	1,200

Sand weighs 100 lb per cu ft.

*Mix is 1:3.

2-Coat Portland Cement Plaster (per 100 sq yd— $\frac{1}{2}$ in.)

Surface	Brown coat 1:3 (10% lime)			Finish coat 1:3 (10% lime)		
	Cement, bags	Lime, lb	Sand, lb	Cement, bags	Lime, lb	Sand, lb
Brick or block	14	140	4,200	4	40	1,200

5.4 STUCCO COVERING CAPACITY PER BAG OF CEMENT*

Proportion (cem.: sand)	Thickness					
	$\frac{1}{4}$ in.	$\frac{3}{8}$ in.	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.
	Area, sq ft					
1:2	100	66	50	40	33	24
1:2 $\frac{1}{2}$	110	77	58	47	38	28
1:3	136	90	66	55	44	33
1:3 $\frac{1}{2}$	150	100	76	62	50	38

*For stucco materials per 100 sq ft of wall, see p. 108.

5.5 PLASTER COVERING CAPACITY

Coat	Ingredients per cubic yard			Average covering capacity per cu yd
	Lime putty, cu ft	Sand, cu ft	Fiber, lb	
Scratch coat(1:2)	13.5	27	3	55 sq yd
Brown coat(1:3)	9.3	27	2	75 sq yd

Lime Putty

<u>Ingredient</u>	<u>Quantity per ton, cu ft</u>
Pulverized quicklime	80
Hydrated lime	46
Gypsum plaster	37
Kennes cement	30
Portland cement	19

White or Finish Coat

<u>Coat</u>	<u>Covering Capacity</u>
White trowel coat (1:2)	400 sq yd per ton
Sand finish (2 lime : 1 $\frac{1}{2}$ Keenes cement : 4 $\frac{1}{2}$ sand)	230 sq yd per ton

SECTION VI

Room Areas and Paint

6.1 WATERPROOFING AND DAMPPROOFING MATERIALS

Concrete Admixes

Compound	Admix per cu yd of concrete	Admix per bag of cement
Waterproofing (liquid)	1½ gal	1 qt
Waterproofing (powder)	12 lb	2 lb
Waterproofing (paste)	8 lb	1½ lb

Exterior Dampproofing (Below Ground)

Asphaltic mastic (trowel coat $\frac{1}{8}$ in.): 4 to 5 gal per 100 sq ft

Asphaltic paint (brush coat)

1st coat: 30 to 40 sq ft per gal

2nd coat: 50 to 70 sq ft per gal

Interior of Exterior Walls (Below Ground)

Asphaltic paint (semimastic, heavy brush coat): 30 to 35 sq ft per gal

Asphaltic paint (standard brush coat)

1 coat: 70 to 80 sq ft per gal

2 coats: 80 to 100 sq ft per gal per coat

Exterior Masonry

Colorless silicone brush coat: 70 to 80 sq ft per gal (usually 1 coat only)

Paraffin wax brush coat: 65 to 75 sq ft per gal

Cement Finish (Walls and Floors)

1:2 cement and sand ($\frac{3}{4}$ in. on walls): Add 2 lb waterproofing powder per bag of cement (or 6 lb powder per 100 sq ft of wall)
Add ½ qt waterproofing liquid per bag of cement (or ¼ gal per 100 sq ft of wall)

1:1:2 floor topping (1 in. thick): As above per bag of cement (8 lb powder per 100 sq ft or 1 gal liquid per 100 sq ft)

Asphaltic Mastic

On structural steel ($\frac{1}{16}$ in.): 4 gal per 100 sq ft

Asphaltic Paint

Brush coat on cut stone: 1 gal per 100 sq ft

6.2 PAINT COVERING CAPACITY

Material	Surface or use	Coverage per gallon, sq ft
Exterior Painting		
Priming paint	Wood	450
	Metal	500
Flat house paint	Over primer	500
	Repainting 1 coat	400
Oil paint	Masonry	300
	Concrete	250
	Stucco (smooth)	200
	Stucco (rough)	150
Stain	Wood shingle siding, first coat	150
	Wood shingle siding, second coat	200
Interior Painting		
Priming paint	Wood	500
Metal primer	Metal	600
Undercoat (enamel)	Over primer	400
Flat	Finish coat	500
Semigloss enamel	Finish coat	450
Satin-gloss enamel	Finish coat	450
Gloss enamel	Finish coat	400
Floor enamel	Floors	500
Aluminum paint	Aluminum, first coat	600
	Aluminum, second coat	700
Spar varnish	Finishing woodwork	600
Clear gloss varnish	Finishing woodwork	600
Lacquer	Over stain	450
Interior stain	Woodwork, first coat	500
	Woodwork, second coat	600
	Woodwork, third coat	700
Miscellaneous		
Barn red oil paint	Repaint barn	450
Rust inhibitor (zinc paint)	Metal	650
Furniture sealer and stain	Unpainted furniture	600

6.3 PAPERHANGING WALLS AND CEILINGS

Size of room, ft	Height of ceiling			Yards of border	Rolls of ceiling
	8 ft	9 ft	10 ft		
	Single rolls for walls				
4 × 8	6	7	8	9	2
4 × 10	7	8	9	11	2
4 × 12	8	9	10	12	2
6 × 10	8	9	10	12	2
6 × 12	9	10	11	13	3
8 × 12	10	11	13	15	4
8 × 14	11	12	14	16	4
10 × 14	12	14	15	18	5
10 × 16	13	15	16	19	6
12 × 16	14	16	17	20	7
12 × 18	15	17	19	22	8
14 × 18	16	18	20	23	8
14 × 22	18	20	22	26	10
15 × 16	15	17	19	23	8
15 × 18	16	18	20	24	9
15 × 20	17	20	22	25	10
15 × 23	19	21	23	28	11
16 × 18	17	19	21	25	10
16 × 20	18	20	22	26	10
16 × 22	19	21	23	28	11
16 × 24	20	22	25	29	12
16 × 26	21	23	26	31	13
17 × 22	19	22	24	28	12
17 × 25	21	23	26	31	13
17 × 28	22	25	26	32	15
17 × 32	24	27	30	35	17
17 × 35	26	29	32	37	18
18 × 22	20	22	25	29	12
18 × 25	21	24	27	31	14
18 × 28	23	26	28	33	16
20 × 26	23	28	28	33	17
20 × 28	24	27	30	34	18
30 × 34	27	30	33	39	21

Allowance for waste is included in all figures.

Deduct one roll for every 36 sq ft of openings.

Deduct one roll for every 2 doors.

Deduct for windows as area of each opening.

One roll of wallpaper equals 36 sq ft (24 ft by 18 in.).

Courtesy Painting & Decorating Contractors of America.

6.4 WALL AREA OF ROOMS (8-ft CEILING), SQ FT

Each 1-ft increase in room length or width increases the room wall area by twice the room height in feet.

Feet	Feet								
	3	4	5	6	7	8	9	10	11
3	96	112	128	144	160	176	192	208	224
4	112	128	144	160	176	192	208	224	240
5	128	144	160	176	192	208	224	240	256
6	144	160	176	192	208	224	240	256	272
7	160	176	192	208	224	240	256	272	288
8	176	192	208	224	240	256	272	288	304
9	192	208	224	240	256	272	288	304	320
10	208	224	240	256	272	288	304	320	336
11	224	240	256	272	288	304	320	336	352
12	240	256	272	288	304	320	336	352	368
13	256	272	288	304	320	336	352	368	384
14	272	288	304	320	336	352	368	384	400
15	288	304	320	336	352	368	384	400	416
16	304	320	336	352	368	384	400	416	432
17	320	336	352	368	384	400	416	432	448
18	336	352	368	384	400	416	432	448	464
19	352	368	384	400	416	432	448	464	480
20	368	384	400	416	432	448	464	480	496
21	384	400	416	432	448	464	480	496	512
22	400	416	432	448	464	480	496	512	528
23	416	432	448	464	480	496	512	528	544
24	432	448	464	480	496	512	528	544	560
25	448	464	480	496	512	528	544	560	576

6.4 WALL AREA OF ROOMS (8-ft CEILING), SQ FT (Cont.)

Each 1-ft increase in room length or width increases the room wall area by twice the room height in feet.

Feet	Feet								
	12	13	14	15	16	17	18	19	20
3	240	256	272	288	304	320	336	352	368
4	256	272	288	304	320	336	352	368	384
5	272	288	304	320	336	352	368	384	400
6	288	304	320	336	352	368	384	400	416
7	304	320	336	352	368	384	400	416	432
8	320	336	352	368	384	400	416	432	448
9	336	352	368	384	400	416	432	448	464
10	352	368	384	400	416	432	448	464	480
11	368	384	400	416	432	448	464	480	496
12	384	400	416	432	448	464	480	496	512
13	400	416	432	448	464	480	496	512	528
14	416	432	448	464	480	496	512	528	544
15	432	448	464	480	496	512	528	544	560
16	448	464	480	496	512	528	544	560	576
17	464	480	496	512	528	544	560	576	592
18	480	496	512	528	544	560	576	592	608
19	496	512	528	544	560	576	592	608	624
20	512	528	544	560	576	592	608	624	640
21	528	544	560	576	592	608	624	640	656
22	544	560	576	592	608	624	640	656	672
23	560	576	592	608	624	640	656	672	688
24	576	592	608	624	640	656	672	688	704
25	592	608	624	640	656	672	688	704	720

8.5 WALL AREA OF ROOMS (9-ft CEILING), SQ FT

Each 1-ft increase in room length or width increases the room wall area by twice the room height in feet.

Feet	Feet								
	3	4	5	6	7	8	9	10	11
3	108	126	144	162	180	198	216	234	252
4	126	144	162	180	198	216	234	252	270
5	144	162	180	198	216	234	252	270	288
6	162	180	198	216	234	252	270	288	306
7	180	198	216	234	252	270	288	306	324
8	198	216	234	252	270	288	306	324	342
9	216	234	252	270	288	306	324	342	360
10	234	252	270	288	306	324	342	360	378
11	252	270	288	306	324	342	360	378	396
12	270	288	306	324	342	360	378	396	414
13	288	306	324	342	360	378	396	414	432
14	306	324	342	360	378	396	414	432	450
15	324	342	360	378	396	414	432	450	468
16	342	360	378	396	414	432	450	468	486
17	360	378	396	414	432	450	468	486	504
18	378	396	414	432	450	468	486	504	522
19	396	414	432	450	468	486	504	522	540
20	414	432	450	468	486	504	522	540	558
21	432	450	468	486	504	522	540	558	576
22	450	468	486	504	522	540	558	576	594
23	468	486	504	522	540	558	576	594	612
24	486	504	522	540	558	576	594	612	630
25	504	522	540	558	576	594	612	630	648

6.5 WALL AREA OF ROOMS (9-ft CEILING), SQ FT (Cont.)

Each 1-ft increase in room length or width increases the room wall area by twice the room height in feet.

Feet	Feet								
	12	13	14	15	16	17	18	19	20
3	270	288	306	324	342	360	378	396	414
4	288	306	324	342	360	378	396	414	432
5	306	324	342	360	378	396	414	432	450
6	324	342	360	378	396	414	432	450	468
7	342	360	378	396	414	432	450	468	486
8	360	378	396	414	432	450	468	486	504
9	378	396	414	432	450	468	486	504	522
10	396	414	432	450	468	486	504	522	540
11	414	432	450	468	486	504	522	540	558
12	432	450	468	486	504	522	540	558	576
13	450	468	486	504	522	540	558	576	594
14	468	486	504	522	540	558	576	594	612
15	486	504	522	540	558	576	594	612	630
16	504	522	540	558	576	594	612	630	648
17	522	540	558	576	594	612	630	648	666
18	540	558	576	594	612	630	648	666	684
19	558	576	594	612	630	648	666	684	702
20	576	594	612	630	648	666	684	702	720
21	594	612	630	648	666	684	702	720	738
22	612	630	648	666	684	702	720	738	756
23	630	648	666	684	702	720	738	756	774
24	648	666	684	702	720	738	756	774	792
25	666	684	702	720	738	756	774	792	810

6.6 WALL AREA OF ROOMS (10-ft CEILING), SQ FT

Each 1-ft increase in room length or width increases the room wall area by twice the room height in feet.

Feet	Feet								
	3	4	5	6	7	8	9	10	11
3	120	140	160	180	200	220	240	260	280
4	140	160	180	200	220	240	260	280	300
5	160	180	200	220	240	260	280	300	320
6	180	200	220	240	260	280	300	320	340
7	200	220	240	260	280	300	320	340	360
8	220	240	260	280	300	320	340	360	380
9	240	260	280	300	320	340	360	380	400
10	260	280	300	320	340	360	380	400	420
11	280	300	320	340	360	380	400	420	440
12	300	320	340	360	380	400	420	440	460
13	320	340	360	380	400	420	440	460	480
14	340	360	380	400	420	440	460	480	500
15	360	380	400	420	440	460	480	500	520
16	380	400	420	440	460	480	500	520	540
17	400	420	440	460	480	500	520	540	560
18	420	440	460	480	500	520	540	560	580
19	440	460	480	500	520	540	560	580	600
20	460	480	500	520	540	560	580	600	620
21	480	500	520	540	560	580	600	620	640
22	500	520	540	560	580	600	620	640	660
23	520	540	560	580	600	620	640	660	680
24	540	560	580	600	620	640	660	680	700
25	560	580	600	620	640	660	680	700	720

6.6 WALL AREA OF ROOMS (10-ft CEILING), SQ FT (Cont.)

Each 1-ft increase in room length or width increases the room wall area by twice the room height in feet.

Feet	Feet								
	12	13	14	15	16	17	18	19	20
3	300	320	340	360	380	400	420	440	460
4	320	340	360	380	400	420	440	460	480
5	340	360	380	400	420	440	460	480	500
6	360	380	400	420	440	460	480	500	520
7	380	400	420	440	460	480	500	520	540
8	400	420	440	460	480	500	520	540	560
9	420	440	460	480	500	520	540	560	580
10	440	460	480	500	520	540	560	580	600
11	460	480	500	520	540	560	580	600	620
12	480	500	520	540	560	580	600	620	640
13	500	520	540	560	580	600	620	640	660
14	520	540	560	580	600	620	640	660	680
15	540	560	580	600	620	640	660	680	700
16	560	580	600	620	640	660	680	700	720
17	580	600	620	640	660	680	700	720	740
18	600	620	640	660	680	700	720	740	760
19	620	640	660	680	700	720	740	760	780
20	640	660	680	700	720	740	760	780	800
21	660	680	700	720	740	760	780	800	820
22	680	700	720	740	760	780	800	820	840
23	700	720	740	760	780	800	820	840	860
24	720	740	760	780	800	820	840	860	880
25	740	760	780	800	820	840	860	880	900

6.7 WALL AREA OF ROOMS (11-ft CEILING), SQ FT

Each 1-ft increase in room length or width increases the room wall area by twice the room height in feet.

Feet	Feet								
	3	4	5	6	7	8	9	10	11
3	132	154	176	198	220	242	264	286	308
4	154	176	198	220	242	264	286	308	330
5	176	198	220	242	264	286	308	330	352
6	198	220	242	264	286	308	330	352	374
7	220	242	264	286	308	330	352	374	396
8	242	264	286	308	330	352	374	396	418
9	264	286	308	330	352	374	396	418	440
10	286	308	330	352	374	396	418	440	462
11	308	330	352	374	396	418	440	462	484
12	330	352	374	396	418	440	462	484	506
13	352	374	396	418	440	462	484	506	528
14	374	396	418	440	462	484	506	528	550
15	396	418	440	462	484	506	528	550	572
16	418	440	462	484	506	528	550	572	594
17	440	462	484	506	528	550	572	594	616
18	462	484	506	528	550	572	594	616	638
19	484	506	528	550	572	594	616	638	660
20	506	528	550	572	594	616	638	660	682
21	528	550	572	594	616	638	660	682	704
22	550	572	594	616	638	660	682	704	726
23	572	594	616	638	660	682	704	726	748
24	594	616	638	660	682	704	726	748	770
25	616	638	660	682	704	726	748	770	792

6.7 WALL AREA OF ROOMS (11-ft CEILING), SQ FT (Cont.)

Each 1-ft increase in room length or width increases the room wall area by twice the room height in feet.

Feet	Feet								
	12	13	14	15	16	17	18	19	20
3	330	352	374	396	418	440	462	484	506
4	352	374	396	418	440	462	484	506	528
5	374	396	418	440	462	484	506	528	550
6	396	418	440	462	484	506	528	550	572
7	418	440	462	484	506	528	550	572	594
8	440	462	484	506	528	550	572	594	616
9	462	484	506	528	550	572	594	616	638
10	484	506	528	550	572	594	616	638	660
11	506	528	550	572	594	616	638	660	682
12	528	550	572	594	616	638	660	682	704
13	550	572	594	616	638	660	682	704	726
14	572	594	616	638	660	682	704	726	748
15	594	616	638	660	682	704	726	748	770
16	616	638	660	682	704	726	748	770	792
17	638	660	682	704	726	748	770	792	814
18	660	682	704	726	748	770	792	814	836
19	682	704	726	748	770	792	814	836	858
20	704	726	748	770	792	814	836	858	880
21	726	748	770	792	814	836	858	880	902
22	748	770	792	814	836	858	880	902	924
23	770	792	814	836	858	880	902	924	946
24	792	814	836	858	880	902	924	946	968
25	814	836	858	880	902	924	946	968	990

**6.8 COMBINED WALL AND CEILING AREA OF ROOMS
(8-ft CEILING), SQ FT**

Feet	Feet											
	3	4	5	6	7	8	9	10	11	12	13	14
3	105	124	143	162	181	200	219	238	257	276	295	314
4	124	144	164	184	204	224	244	264	284	304	324	344
5	143	164	185	206	227	248	269	290	311	332	353	374
6	162	184	206	228	250	272	294	316	338	360	382	404
7	181	204	227	250	273	296	319	342	365	388	411	434
8	200	224	248	272	296	320	344	368	392	416	440	464
9	219	244	269	294	319	344	369	394	419	444	469	494
10	238	264	290	316	342	368	394	420	446	472	498	524
11	257	284	311	338	365	392	419	446	473	500	527	554
12	276	304	332	360	388	416	444	472	500	528	556	584
13	295	324	353	382	411	440	469	498	527	556	585	614
14	314	344	374	404	434	464	494	524	554	584	614	644
15	333	364	395	426	457	488	519	550	581	612	643	674
16	352	384	416	448	480	512	544	576	608	640	672	704
17	371	404	437	470	503	536	569	602	635	668	701	734
18	390	424	458	492	526	560	594	628	662	696	730	764
19	409	444	479	514	549	584	619	654	689	724	759	794
20	428	464	500	536	572	608	644	680	716	752	788	824

	Feet										
Feet	15	16	17	18	19	20	21	22	23	24	25
3	333	352	371	390	409	428	447	466	485	504	523
4	364	384	404	424	444	464	484	504	524	544	564
5	395	416	437	458	479	500	521	542	563	584	605
6	426	448	470	492	514	536	558	580	602	624	646
7	457	480	503	526	549	572	595	618	641	664	687
8	488	512	536	560	584	608	632	656	680	704	728
9	519	544	569	594	619	644	669	694	719	744	769
10	550	576	602	628	654	680	706	732	758	784	810
11	581	608	635	662	689	716	743	770	797	824	851
12	612	640	668	696	724	752	780	808	836	864	892
13	643	672	701	730	759	788	817	846	875	904	933
14	674	704	734	764	794	824	854	884	914	944	974
15	705	736	767	798	829	860	891	922	953	984	1,015
16	736	768	800	832	864	896	928	960	992	1,024	1,056
17	767	800	833	866	899	932	965	998	1,031	1,064	1,097
18	798	832	866	900	934	968	1,002	1,036	1,070	1,104	1,138
19	829	864	899	934	969	1,004	1,039	1,074	1,109	1,144	1,179
20	860	896	932	968	1,004	1,040	1,076	1,112	1,148	1,184	1,220

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6.9 COMBINED WALL AND CEILING AREA OF ROOMS
(8½-ft CEILING), SQ FT

Feet	Feet											
	3	4	5	6	7	8	9	10	11	12	13	14
3	111	131	151	171	191	211	231	251	271	291	311	331
4	131	152	173	194	215	236	257	278	299	320	341	362
5	151	173	195	217	239	261	283	305	327	349	371	393
6	171	194	217	240	263	286	309	332	355	378	401	424
7	191	215	239	263	287	311	335	359	383	407	431	455
8	211	236	261	286	311	336	361	386	411	436	461	486
9	231	257	283	309	335	361	387	413	439	465	491	517
10	251	278	305	332	359	386	413	440	467	494	521	548
11	271	299	327	355	383	411	439	467	495	523	551	579
12	291	320	349	378	407	436	465	494	523	552	581	610
13	311	341	371	401	431	461	491	521	551	581	611	641
14	331	362	393	424	455	486	517	548	579	610	641	672
15	351	383	415	447	479	511	543	575	607	639	671	703
16	371	404	437	470	503	536	569	602	635	668	701	734
17	391	425	459	493	527	561	595	629	663	697	731	765
18	411	446	481	516	551	586	621	656	691	726	761	796
19	431	467	503	539	575	611	647	683	719	755	791	827
20	451	488	525	562	599	636	673	710	747	784	821	858

	Feet										
Feet	15	16	17	18	19	20	21	22	23	24	25
3	351	371	391	411	431	451	471	491	511	531	551
4	383	404	425	446	467	488	509	530	551	572	593
5	415	437	459	481	503	525	547	569	591	613	635
6	447	470	493	516	539	562	585	608	631	654	677
7	479	503	527	551	575	599	623	647	671	695	719
8	511	536	561	586	611	636	661	686	711	736	761
9	543	569	595	621	647	673	699	725	751	777	803
10	575	602	629	656	683	710	737	764	791	818	845
11	607	635	663	691	719	747	775	803	831	859	887
12	639	668	697	726	755	784	813	842	871	900	929
13	671	701	731	761	791	821	851	881	911	941	971
14	703	734	765	796	827	858	889	920	951	982	1,013
15	735	767	799	831	863	895	927	959	991	1,023	1,055
16	767	800	833	866	899	932	965	998	1,031	1,064	1,097
17	799	833	867	901	935	969	1,003	1,037	1,071	1,105	1,139
18	831	866	901	936	971	1,006	1,041	1,076	1,111	1,146	1,181
19	863	899	935	971	1,007	1,043	1,079	1,115	1,151	1,187	1,223
20	895	932	969	1,006	1,043	1,080	1,117	1,154	1,191	1,228	1,265

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6.10 COMBINED WALL AND CEILING AREA OF ROOMS
(9-ft CEILING), SQ FT

Feet	Feet											
	3	4	5	6	7	8	9	10	11	12	13	14
3	117	138	159	180	201	222	243	264	285	306	327	348
4	138	160	182	204	226	248	270	292	314	336	358	380
5	159	182	205	228	251	274	297	320	343	366	389	412
6	180	204	228	252	276	300	324	348	372	396	420	444
7	201	226	251	276	301	326	351	376	401	426	451	476
8	222	248	274	300	326	352	378	404	430	456	482	508
9	243	270	297	324	351	378	405	432	459	486	513	540
10	264	292	320	348	376	404	432	460	488	516	544	572
11	285	314	343	372	401	430	459	488	517	546	575	604
12	306	336	366	396	426	456	486	516	546	576	606	636
13	327	358	389	420	451	482	513	544	575	606	637	668
14	348	380	412	444	476	508	540	572	604	636	668	700
15	369	402	435	468	501	534	567	600	633	666	699	732
16	390	424	458	492	526	560	594	628	662	696	730	764
17	411	446	481	516	551	586	621	656	691	726	761	796
18	432	468	504	540	576	612	648	684	720	756	792	828
19	453	490	527	564	601	638	675	712	749	786	823	860
20	474	512	550	588	626	664	702	740	778	816	854	892

Feet	Feet										
	15	16	17	18	19	20	21	22	23	24	25
3	369	390	411	432	453	474	495	516	537	558	579
4	402	424	446	468	490	512	534	556	578	600	622
5	435	458	481	504	527	550	573	596	619	642	665
6	468	492	516	540	564	588	612	636	660	684	708
7	501	526	551	576	601	626	651	676	701	726	751
8	534	560	586	612	638	664	690	716	742	768	794
9	567	594	621	648	675	702	729	756	783	810	837
10	600	628	656	684	712	740	768	796	824	852	880
11	633	662	691	720	749	778	807	836	865	894	923
12	666	696	726	756	786	816	846	876	906	936	966
13	699	730	761	792	823	854	885	916	947	978	1,009
14	732	764	796	828	860	892	924	956	988	1,020	1,052
15	765	798	831	864	897	930	963	996	1,029	1,062	1,095
16	798	832	866	900	934	968	1,002	1,036	1,070	1,104	1,138
17	831	866	901	936	971	1,006	1,041	1,076	1,111	1,146	1,181
18	864	900	936	972	1,008	1,044	1,080	1,116	1,152	1,188	1,224
19	897	934	971	1,008	1,045	1,082	1,119	1,156	1,193	1,230	1,267
20	930	968	1,006	1,044	1,082	1,120	1,158	1,196	1,234	1,272	1,310

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**6.11 COMBINED WALL AND CEILING AREA OF ROOMS
(10-ft CEILING), SQ FT**

	Feet												
Feet	3	4	5	6	7	8	9	10	11	12	13	14	
3	129	152	175	198	221	244	267	290	313	336	359	382	
4	152	176	200	224	248	272	296	320	344	368	392	416	
5	175	200	225	250	275	300	325	350	375	400	425	450	
6	198	224	250	276	302	328	354	380	406	432	458	484	
7	221	248	275	302	329	356	383	410	437	464	491	518	
8	244	272	300	328	356	384	412	440	468	496	524	552	
9	267	296	325	354	383	412	441	470	499	528	557	586	
10	290	320	350	380	410	440	470	500	530	560	590	620	
11	313	344	375	406	437	468	499	530	561	592	623	654	
12	336	368	400	432	464	496	528	560	592	624	656	688	
13	359	392	425	458	491	524	557	590	623	656	689	722	
14	382	416	450	484	518	552	586	620	654	688	722	756	
15	405	440	475	510	545	580	615	650	685	720	755	790	
16	428	464	500	536	572	608	644	680	716	752	788	824	
17	451	488	525	562	599	636	673	710	747	784	821	858	
18	474	512	550	588	626	664	702	740	778	816	854	892	
19	497	536	575	614	653	692	731	770	809	848	887	926	
20	520	560	600	640	680	720	760	800	840	880	920	960	

	Feet										
Feet	15	16	17	18	19	20	21	22	23	24	25
3	405	428	451	474	497	520	543	566	589	612	635
4	440	464	488	512	536	560	584	608	632	656	680
5	475	500	525	550	575	600	625	650	675	700	725
6	510	536	562	588	614	640	666	692	718	744	770
7	545	572	599	626	653	680	707	734	761	788	815
8	580	608	636	664	692	720	748	776	804	832	860
9	615	644	673	702	731	760	789	818	847	876	905
10	650	680	710	740	770	800	830	860	890	920	950
11	685	716	747	778	809	840	871	902	933	964	995
12	720	752	784	816	848	880	912	944	976	1,008	1,040
13	755	788	821	854	887	920	953	986	1,019	1,052	1,085
14	790	824	858	892	926	960	994	1,028	1,062	1,096	1,130
15	825	860	895	930	965	1,000	1,035	1,070	1,105	1,140	1,175
16	860	896	932	968	1,004	1,040	1,076	1,112	1,148	1,184	1,220
17	895	932	969	1,006	1,043	1,080	1,117	1,154	1,191	1,228	1,265
18	930	968	1,006	1,044	1,082	1,120	1,158	1,196	1,234	1,272	1,310
19	965	1,004	1,043	1,082	1,121	1,160	1,199	1,238	1,277	1,316	1,355
20	1,000	1,040	1,080	1,120	1,160	1,200	1,240	1,280	1,320	1,360	1,400

**6.12 COMBINED WALL AND CEILING AREA OF ROOMS
(11-ft CEILING), SQ FT**

Feet	Feet											
	3	4	5	6	7	8	9	10	11	12	13	14
3	141	166	191	216	241	266	291	316	341	366	391	416
4	166	192	218	244	270	296	322	348	374	400	426	452
5	191	218	245	272	299	326	353	380	407	434	461	488
6	216	244	272	300	328	356	384	412	440	468	496	524
7	241	270	299	328	357	386	415	444	473	502	531	560
8	266	296	326	356	386	416	446	476	506	536	566	596
9	291	322	353	384	415	446	477	508	539	570	601	632
10	316	348	380	412	444	476	508	540	572	604	636	668
11	341	374	407	440	473	506	539	572	605	638	671	704
12	366	400	434	468	502	536	570	604	638	672	706	740
13	391	426	461	496	531	566	601	636	671	706	741	776
14	416	452	488	524	560	596	632	668	704	740	776	812
15	441	478	515	552	589	626	663	700	737	774	811	848
16	466	504	542	580	618	656	694	732	770	808	846	884
17	491	530	569	608	647	686	725	764	803	842	881	920
18	516	556	596	636	676	716	756	796	836	876	916	956
19	541	582	625	664	705	746	787	828	869	910	951	992
20	566	608	650	692	734	776	818	860	902	944	986	1,028

Feet	Feet										
	15	16	17	18	19	20	21	22	23	24	25
3	441	466	491	516	541	566	591	616	641	666	691
4	478	504	530	556	582	608	634	660	686	712	738
5	515	542	569	596	623	650	677	704	731	758	785
6	552	580	608	636	664	692	720	748	776	804	832
7	589	618	647	676	705	734	763	792	821	850	879
8	626	656	686	716	746	776	806	836	866	896	926
9	663	694	725	756	787	818	849	880	911	942	973
10	700	732	764	796	828	860	892	924	956	988	1,020
11	737	770	803	836	869	902	935	968	1,001	1,034	1,067
12	774	808	842	876	910	944	978	1,012	1,046	1,080	1,114
13	811	846	881	916	951	986	1,021	1,056	1,091	1,126	1,161
14	848	884	920	956	992	1,028	1,064	1,100	1,136	1,172	1,208
15	885	922	959	996	1,033	1,070	1,107	1,144	1,181	1,218	1,255
16	922	960	998	1,036	1,074	1,112	1,150	1,188	1,226	1,264	1,302
17	959	998	1,037	1,076	1,115	1,154	1,193	1,232	1,271	1,310	1,349
18	996	1,036	1,076	1,116	1,156	1,196	1,236	1,276	1,316	1,356	1,396
19	1,033	1,074	1,115	1,156	1,197	1,238	1,279	1,320	1,361	1,402	1,443
20	1,070	1,112	1,154	1,196	1,238	1,280	1,322	1,364	1,406	1,448	1,490

SECTION VII

Carpentry and Lumber

7.1 STANDARD TIMBER SIZES

PROPERTIES FOR DESIGNING

NATIONAL LUMBER MANUFACTURERS ASSOCIATION

Nominal Size	American Standard Dressed Size	Area of Section	Weight per Foot	Moment of Inertia	Section Modulus	Nominal Size	American Standard Dressed Size	Area of Section	Weight per Foot	Moment of Inertia	Section Modulus
In.	In.	In. ²	Lb.	In. ⁴	In. ³	In.	In.	In. ²	Lb.	In. ⁴	In. ³
2 x 4	1½ x 3½	5.89	1.64	6.45	3.56	10x10	9½ x 9½	90.3	25.0	679	143
6	5½	9.14	2.54	24.1	8.57	12	11½	109	30.3	1204	209
8	7½	12.2	3.39	57.1	15.3	14	13½	128	35.6	1948	289
10	9½	15.4	4.29	116	24.4	16	15½	147	40.9	2948	380
12	11½	18.7	5.19	206	35.8	18	17½	166	46.1	4243	485
14	13½	21.9	6.09	333	49.4	20	19½	185	51.4	5870	602
16	15½	25.2	6.99	504	68.1	22	21½	204	56.7	7868	732
18	17½	28.4	7.90	726	92.9	24	23½	223	62.0	10274	874
3 x 4	2½ x 3½	9.52	2.64	10.4	5.75	12x12	11½ x 11½	132	36.7	1458	253
6	5½	14.8	4.10	38.9	13.8	14	13½	155	43.1	2358	349
8	7½	19.7	5.47	92.3	24.6	16	15½	178	49.5	3569	460
10	9½	24.9	6.93	188	39.5	18	17½	201	55.9	5136	587
12	11½	30.2	8.39	333	57.9	20	19½	224	62.3	7106	729
14	13½	35.4	9.84	538	79.7	22	21½	247	68.7	9524	886
16	15½	40.7	11.3	815	105	24	23½	270	75.0	12437	1058
18	17½	45.9	12.8	1172	134	14x14	13½ x 13½	182	50.6	2768	410
4 x 4	3½ x 3½	13.1	3.65	14.4	7.94	16	15½	209	58.1	4189	541
6	5½	20.4	5.66	53.8	19.1	18	17½	236	65.6	6029	689
8	7½	27.2	7.55	127	34.0	20	19½	263	73.1	8342	856
10	9½	34.4	9.57	259	54.5	22	21½	290	80.6	11181	1040
12	11½	41.7	11.6	459	79.9	24	23½	317	88.1	14600	1243
14	13½	48.9	13.6	743	110	16x16	15½ x 15½	240	66.7	4810	621
16	15½	56.2	15.6	1125	145	18	17½	271	75.3	6923	791
18	17½	63.4	17.6	1619	185	20	19½	302	83.9	9578	982
6 x 6	5½ x 5½	30.3	8.40	76.3	27.7	22	21½	333	92.5	12837	1194
8	7½	41.3	11.4	193	51.6	24	23½	364	101	16763	1427
10	9½	52.3	14.5	393	82.7	18x18	17½ x 17½	306	85.0	7816	893
12	11½	63.3	17.5	697	121	20	19½	341	94.8	10613	1109
14	13½	74.3	20.6	1128	167	22	21½	376	105	14493	1348
16	15½	85.3	23.6	1707	220	24	23½	411	114	18926	1611
18	17½	96.3	26.7	2456	281	26	25½	446	124	24181	1897
20	19½	107.3	29.8	3398	349	20x20	19½ x 19½	380	106	12049	1236
8 x 8	7½ x 7½	56.3	15.6	264	70.3	22	21½	419	116	16150	1502
10	9½	71.3	19.8	536	113	24	23½	458	127	21089	1795
12	11½	86.3	23.9	951	165	26	25½	497	138	26945	2113
14	13½	101.3	28.0	1538	228	28	27½	536	149	33795	2458
16	15½	116.3	32.0	2327	300	24x24	23½ x 23½	552	153	25415	2163
18	17½	131.3	36.4	3350	383	26	25½	599	166	32472	2547
20	19½	146.3	40.6	4634	475	28	27½	646	180	40727	2902
22	21½	161.3	44.8	6211	578	30	29½	693	193	50275	3408

All properties and weights given are for dressed size only.
The weights given above are based on assumed average weight of 40 pounds per cubic foot.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

7.2 WORKING STRESSES FOR STRUCTURAL LUMBER

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Stress-grades, Species	Commercial Name	Allowable Unit Stresses in Pounds Per Square Inch			
		Tension (b) Parallel to Grain in Bending	Max. Horiz- ontal Shear	Compress- ion Per- pendicular to Grain	Modulus of Elastic- ity
1800#f WHITE ASH	1800#f White Ash	1800	180	500	1500000
1600#f WHITE ASH	1600#f White Ash	1600	180		
1400#f WHITE ASH	1400#f White Ash	1400	180		
1200#f WHITE ASH	1200#f White Ash	1200	100		
1000#f WESTERN RED CEDAR	Structural	1000	100	300	1000000
1400#f TIDEWATER RED CYPRESS	1400#f Tidewater Red Cypress	1400	180	300	1200000
1100#f TIDEWATER RED CYPRESS	1100#f Tidewater Red Cypress	1100	100		
1400#f SOUTHERN CYPRESS	1400#f Southern Cypress	1400	180	300	1200000
1100#f SOUTHERN CYPRESS	1100#f Southern Cypress	1100	100		
1800#f DENSE DOUGLAS FIR (COAST REGION)	Dense Select Structural	1800	190	380	1600000
1600#f CLOSE-GRAINED DOUGLAS FIR (COAST REGION)	Select Structural	1600	100	345	
1200#f DOUGLAS FIR (COAST REGION)	1200#f Framing and Joist	1200	100	325	
900#f DOUGLAS FIR (COAST REGION)	900#f Framing and Joist	900	100	325	
1800#f DENSE DOUGLAS FIR (INLAND EMPIRE)	Select Structural	1800	190	380	1600000
1600#f CLOSE-GRAINED DOUGLAS FIR (INLAND EMPIRE)	Structural	1600	85	335	
1200#f DOUGLAS FIR (INLAND EMPIRE)	Common Structural	1200	80	315	
1100#f EASTERN HEMLOCK	Select Structural	1100	70	300	1100000
1000#f EASTERN HEMLOCK	1000 SG Eastern Hemlock	1000	52		
900#f EASTERN HEMLOCK	900 SG Eastern Hemlock	900	52		
800#f EASTERN HEMLOCK	800 SG Eastern Hemlock	800	52		
1040#f WEST COAST HEMLOCK	No. 1 Dimension	1040(c)	100	300	1400000

1800#f OAK, RED AND WHITE	1800#f Oak, Red and White	1800	120	500	1500000
1600#f OAK, RED AND WHITE	1600#f Oak, Red and White	1600	120		
1400#f OAK, RED AND WHITE	1400#f Oak, Red and White	1400	120		
1200#f OAK, RED AND WHITE	1200#f Oak, Red and White	1200	100		
1000#f NORWAY PINE	1000 SG Norway Pine	1000	64	300	1200000
900#f NORWAY PINE	900 SG Norway Pine	900	64		
800#f NORWAY PINE	800 SG Norway Pine	800	64		
2000#f DENSE LONGLEAF SOUTHERN PINE	Select Structural	2000	100		
1800#f DENSE LONGLEAF SOUTHERN PINE	Prime Structural	1800	100		
1600#f DENSE LONGLEAF SOUTHERN PINE	Merchandise Structural	1600	100	380	1600000
1600#f DENSE LONGLEAF SOUTHERN PINE	Structural Sq. Edge & Sound	1600	100		
1400#f DENSE LONGLEAF SOUTHERN PINE	No. 1 Structural	1400	100		
1400#f DENSE LONGLEAF SOUTHERN PINE	No. 1 L L Dimension	1400	100		
1050#f DENSE LONGLEAF SOUTHERN PINE	No. 2 L L—1050f Dimension	1050	100		
2000#f DENSE SHORTLEAF SOUTHERN PINE	Dense Select Structural	2000	100		
1800#f DENSE SHORTLEAF SOUTHERN PINE	Dense Structural	1800	100		
1600#f DENSE SHORTLEAF SOUTHERN PINE	Dense Str. Sq. Edge & Sound	1600	100		
1400#f DENSE SHORTLEAF SOUTHERN PINE	Dense No. 1 Structural	1400	100	380	1600000
1400#f DENSE SHORTLEAF SOUTHERN PINE	No. 1 Dense Dimension	1400	100		
1200#f SHORTLEAF SOUTHERN PINE	No. 1 Dimension	1200	100		
1050#f DENSE SHORTLEAF SOUTHERN PINE	No. 2 Dense—1050f Dimension	1050	100		
900#f SHORTLEAF SOUTHERN PINE	No. 2 Medium Grain—900f Dim.	900	100		
1600#f CLOSE-GRAINED REDWOOD	1600#f Close-Grained Redwood	1600	80		
1400#f CLOSE-GRAINED REDWOOD	Dense Select All-Ht. Redwood	1400	80	267	1200000
1200#f CLOSE-GRAINED REDWOOD	Select All-Heart Redwood	1200	70		
1200#f EASTERN SPRUCE	1200#f Eastern Spruce	1200	90	250	1200000
1000#f EASTERN SPRUCE	1000#f Eastern Spruce	1000	80		
1000#f EASTERN SPRUCE	1000#f Eastern Spruce	1000	80		

(b) Tension parallel to grain only.

(c) With slope of grain not more than 1 to 10.

7.3 LUMBER CONVERTED TO BOARD FEET

One board foot equals one lineal foot of 1 in. \times 12 in. board or its equivalent.

Lumber sizes, in.	Board feet per lin ft	Board feet for standard lengths						
		8 ft	10 ft	12 ft	14 ft	16 ft	18 ft	20 ft
1 \times 2	0.166	1.33	1.67	2.0	2.33	2.67	3.0	3.33
1 \times 3	0.25	2.00	2.50	3.0	3.5	4.0	4.5	5.0
1 \times 4; 2 \times 2	0.333	2.67	3.33	4.00	4.67	5.33	6.0	6.67
1 \times 6; 2 \times 3	0.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
1 \times 8; 2 \times 4	0.667	5.34	6.67	8.0	9.34	10.67	12.0	13.34
1 \times 12; 2 \times 6; 3 \times 4	1.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0
2 \times 8; 4 \times 4	1.333	10.66	13.33	16.0	18.66	21.33	24.0	26.66
2 \times 10	1.667	13.34	16.67	20.0	23.34	26.67	30.0	33.34
2 \times 12; 3 \times 8; 4 \times 6	2.0	16.0	20.0	24.0	28.0	32.0	36.0	40.0
2 \times 14	2.333	18.66	23.33	28.0	32.66	37.33	42.0	46.66
2 $\frac{1}{2}$ \times 12; 3 \times 10	2.5	20.0	25.0	30.0	35.0	40.0	45.0	50.0
2 $\frac{1}{2}$ \times 14	2.917	23.34	29.17	35.0	40.84	46.67	52.50	58.34
2 $\frac{1}{2}$ \times 16; 4 \times 10	3.333	26.66	33.33	40.0	46.62	53.33	60.0	66.66
3 \times 6	1.5	12.0	15.0	18.0	21.0	24.0	27.0	30.0
3 \times 12; 6 \times 6	3.0	24.0	30.0	36.0	42.0	48.0	54.0	60.0
3 \times 14	3.5	28.0	35.0	42.0	49.0	56.0	63.0	70.0
3 \times 16; 4 \times 12; 6 \times 8	4.0	32.0	40.0	48.0	56.0	64.0	72.0	80.0
4 \times 8	2.667	21.34	26.67	32.0	37.34	42.67	48.00	53.34
4 \times 14	4.667	37.34	46.67	56.0	65.34	74.67	84.00	93.34
4 \times 16; 8 \times 8	5.333	42.66	53.33	64.0	74.66	85.33	96.0	106.66
6 \times 10	5.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
6 \times 12	6.0	48.0	60.0	72.0	84.0	96.0	108.0	120.0
6 \times 14	7.0	56.0	70.0	84.0	96.0	112.0	126.0	140.0
6 \times 16; 8 \times 12	8.0	64.0	80.0	96.0	112.0	128.0	144.0	160.0
8 \times 10	6.667	53.34	66.67	80.0	93.34	106.67	120.00	133.34
8 \times 14	9.333	74.66	93.33	112.0	130.67	149.33	168.0	186.66
8 \times 16	10.667	85.34	106.67	128.00	149.34	170.67	192.00	213.34

7.4 SPACING OF JOISTS, STUDS, AND RAFTERS

Wall or room length, ft	Spacing of framing members					
	12 in.	14 in.	16 in.	18 in.	20 in.	24 in.
	No. of pieces (including 1 extra for end)					
4	5	5	4	4	4	3
5	6	5	5	4	4	4
6	7	7	6	5	5	4
7	8	7	6	6	5	5
8	9	8	7	7	6	5
9	10	9	8	7	6	6
10	11	10	9	8	7	6
11	12	11	9	9	8	7
12	13	11	10	9	8	7
13	14	12	11	10	9	8
14	15	13	12	11	9	8
15	16	14	12	11	10	9
16	17	15	13	12	11	9
17	18	16	14	13	11	10
18	19	17	15	13	12	10
19	20	18	15	14	12	11
20	21	18	16	15	13	11
21	22	19	17	15	14	12
22	23	20	18	16	14	12
23	24	22	18	17	15	13
24	25	23	19	17	15	13
25	26	24	20	18	16	14
26	27	24	21	19	17	14
27	28	25	21	19	17	15
28	29	25	22	20	18	15
29	30	26	23	21	18	16
30	31	27	24	21	19	16
31	32	28	24	22	20	17
32	33	29	25	23	20	17
33	34	31	26	23	21	18
34	35	30	27	24	21	18
35	36	31	27	25	22	19
36	37	32	28	25	23	19
37	38	33	29	26	23	20
38	39	34	30	27	24	20
39	40	35	30	27	24	21
40	41	35	31	28	25	21
41	42	36	32	29	26	22
42	43	37	33	29	26	22
43	44	38	34	30	27	23
44	45	39	34	31	28	23
45	46	40	35	31	28	24
46	47	41	36	32	29	24
47	48	42	36	33	30	25
48	49	43	37	33	30	25
49	50	44	38	34	31	26
50	51	45	39	35	31	26

7.5 BOARD FEET OF LUMBER IN PARTITIONS

Single plate top and bottom; 2 in. \times 4 in. studs at 14-in. centers. For additional top or bottom plates, add $\frac{2}{3}$ bfm per plate per lin ft of partition.

Length of partition, ft-in.	Height of partition				
	8 ft	9 ft	10 ft	11 ft	12 ft
	Board feet				
3-6	27	30	32	35	38
4-8	34	37	40	44	47
5-10	40	44	48	52	56
7-0	47	52	56	61	66
8-2	54	60	65	70	76
9-4	61	67	74	79	85
10-6	68	75	82	88	95
11-8	75	82	90	97	104
12-10	82	90	98	106	114
14-0	88	97	106	114	123
15-2	96	105	114	124	133
16-4	103	113	123	133	143
17-6	110	120	131	142	152
18-8	116	128	139	150	162
19-10	123	135	147	159	171
21-0	131	143	156	166	182
22-2	138	151	164	178	191
23-4	144	158	172	186	200
24-6	151	166	180	195	210
25-8	158	173	188	204	219
26-10	164	180	196	212	228
28-0	171	188	204	221	238
29-2	179	196	214	231	248
30-4	186	204	222	240	258
31-6	192	211	230	248	267
32-8	199	218	238	257	276
33-10	206	226	246	266	286
35-0	212	233	254	274	295
36-2	220	241	262	284	305
37-4	226	248	270	292	314
38-6	234	256	279	302	324
39-8	240	264	287	310	334
40-10	247	271	295	319	343
42-0	254	278	303	328	352

7.5 BOARD FEET OF LUMBER IN PARTITIONS (Cont.)

Single top and bottom plate; 2 in. \times 4 in. studs at 16-in. centers. For additional top or bottom plates, add $\frac{1}{2}$ bfm per plate per lin ft of partition.

Length of partition, ft-in.	Height of partition				
	8 ft	9 ft	10 ft	11 ft	12 ft
	Board feet				
4-0	27	30	32	35	38
5-4	35	38	42	45	48
6-8	42	46	50	54	58
8-0	48	53	58	62	67
9-4	56	62	67	72	78
10-8	63	69	75	81	87
12-0	70	76	83	90	96
13-4	77	84	92	99	106
14-8	84	92	100	108	116
16-0	91	100	108	117	126
17-4	99	108	118	127	136
18-8	106	116	126	136	146
20-0	112	123	134	144	155
21-4	120	132	143	154	166
22-8	127	139	151	163	175
24-0	134	146	159	172	184
25-4	141	154	168	181	194
26-8	148	162	176	190	204
28-0	155	170	184	199	214
29-4	163	178	194	209	224
30-8	170	186	202	218	234
32-0	176	193	210	226	243
33-4	184	201	218	236	253
34-8	191	209	227	245	263
36-0	198	216	235	254	272
37-4	205	224	244	263	282
38-8	212	232	252	272	292
40-0	219	240	260	281	302
41-4	227	248	270	291	312
42-8	234	256	278	300	322
44-0	240	263	286	308	331

7.5 BOARD FEET OF LUMBER IN PARTITIONS (Cont.)

Single top and bottom plates; 2 in. × 4 in. studs at 18-in. centers.

Length of partition, ft-in.	Height of partition				
	8 ft	9 ft	10 ft	11 ft	12 ft
	Board feet				
4-6	28	30	33	36	38
6-0	35	38	42	45	48
7-6	42	46	50	54	58
9-0	50	54	59	64	68
10-6	57	62	68	73	78
12-0	64	70	76	82	88
13-6	72	78	85	92	98
15-0	79	86	94	101	108
16-6	86	94	102	110	118
18-0	94	102	111	120	128
19-6	101	110	120	129	138
21-0	108	118	128	138	148
22-6	116	126	137	148	158
24-0	123	134	146	157	168
25-6	130	142	154	166	178
27-0	138	150	163	176	188
28-6	145	158	172	185	198
30-0	152	166	180	194	208
31-6	160	174	189	204	218
33-0	167	182	198	213	228
34-6	174	190	206	222	238
36-0	182	198	215	232	248
37-6	189	206	224	241	258
39-0	196	214	232	250	268
40-6	204	222	241	260	278
42-0	211	230	250	269	288

7.6 BOARDING AND FLOORING

Milling and Waste Allowance

Type of board	Nominal size, in.	Lays, in.	Add for milling, %	Add for cutting and waste, %*	Total add, %
Square edged	1 × 6	5½	9	6	15
	1 × 7	6½	8	6	14
	1 × 8	7½	7	6	13
	1 × 10	9½	6	8	14
	1 × 12	11½	4½	8½	13
Tongue and groove	1 × 3	2½	33	7	40
	1 × 4	3½	23	7	30
	1 × 6	5½	14	8	22
	1 × 8	7½	11	8	19

*If boards are laid diagonally, add 5 per cent to waste. For walls with door and window openings, add 3 per cent to waste.

7.7 WOOD SIDING, SHIPLAP, AND FINISH BOARDING*

Type	Nominal width, in.	Lays, in.	Add for milling, %	Add for cutting and waste, %	Total add, %
Drop siding	6	5½	14	8	22
	8	7½	11	8	19
Shiplap	8	7½	11	9	20
	10	9½	8	9	17
Bevel siding	4	2½	46	8	54
	5	3½	33	8	41
	6	4½	26	9	35
	8	6½	19	10	29
	10	8½	15	10	25
	12	10½	12	10	22

*See Table 7.8 for redwood boarding and siding.

7.8 REDWOOD BOARDING AND SIDING

Type	Nominal width, in.	Lays, in.	Add for milling and lap, %	Add for cutting and waste, %	Total add, %
Drop siding	6	5½	14		23
	8	7½	11	9	20
Shiplap	4	3	33	8	41
	6	5	20	8	28
	8	7	14	10	24
	10	9	11	10	21
	12	11	9	10	19
Shiplap (paneled)	8	7½	11½	10	21½
	10	9½	9	10	19
	12	11½	7	10	17
Bevel siding, plain	4	2½	46	8	54
	5	3½	33	9	42
	6	4½	33	9	42
	8	6	33	10	43
	10	8	25	10	35
	12	10	20	10	30
Rabbeted	4	3	33	8	41
	6	5	20	9	29
	8	7	14	10	24
Anzac	8	6½	28	10	38
	10	8½	21	10	31
	12	10½	17	10	27

7.9 NAILS

Size	Length, in.	Type		
		Common	Casing	Finishing
		Approx. number per lb		
2d	1	830		1,351
3d	1 $\frac{1}{4}$	528		807
4d	1 $\frac{1}{2}$	316	473	584
5d	1 $\frac{3}{4}$	271		500
6d	2	168	236	309
7d	2 $\frac{1}{4}$	150	210	
8d	2 $\frac{1}{2}$	106	145	189
9d	2 $\frac{3}{4}$	96		
10d	3	69	94	121
12d	3 $\frac{1}{4}$	63		
16d	3 $\frac{1}{2}$	49	71	90
20d	4	31	52	62
30d	4 $\frac{1}{2}$	24		
40d	5	18		
50d	5 $\frac{1}{2}$	14		
60d	6	11		

Lathing Nails

Size	Gauge	Approx. number per lb
2d	16 $\frac{1}{2}$	1,265
3d	15	752
3d	16	976

Wire Spikes

Size, in.	Gauge	Approx. number per lb
6	1	9
7	2	6
8	3	4
9	4	3 $\frac{1}{2}$
10	5	3
12	6	2 $\frac{1}{2}$

7.9 NAILS (Cont.)

Flooring Brads

Size	Gauge	Approx. number per lb
7d	11	139
8d	10	99
10d	9	69
8d	11	123

Shingle Nails

Size	Gauge	Approx. number per lb
3d	13	429
3½d	12½	345
4d	12	274
5d	12	235

Double-headed Nails

Size, in.	Over-all length, in.	Approx. number per lb
1½	3	156
2½	2½	90
2¾	3¼	59
3	3½	45
3½	3¾	28

Plasterboard Nails

Size, in.	Approx. number per lb
1	469
1½	448
1¾	387
1½	339
1½ (½ in. head)	419

7.10 SAFE LOADS FOR STRUCTURAL LUMBER

Span, ft	Width × depth, in.									
	1 × 4	1 × 6	1 × 7	1 × 8	1 × 9	1 × 10	1 × 12	1 × 14	1 × 15	1 × 16
	Safe load uniformly distributed, lb*									
6	533	1,200	1,633	2,133	2,700	3,333	4,800	6,533	7,500	8,533
8	400	900	1,225	1,600	2,025	2,500	3,600	4,900	5,633	6,400
10	320	720	980	1,280	1,620	2,000	2,880	3,920	4,500	5,120
12	267	600	816	1,066	1,350	1,666	2,400	3,266	3,750	4,266
14	228	514	700	914	1,157	1,428	2,056	2,800	3,214	3,656
15	213	480	653	853	1,080	1,333	1,920	2,613	3,000	3,412
16	200	450	612	800	1,012	1,250	1,800	2,450	2,816	3,200
17	188	423	576	753	953	1,176	1,694	2,306	2,653	3,012
18	178	400	544	711	900	1,111	1,600	2,177	2,500	2,844
20	160	360	490	640	810	1,000	1,440	1,960	2,250	2,560
22	145	327	445	582	736	909	1,309	1,782	2,045	2,327
23	139	313	426	556	704	869	1,252	1,704	1,956	2,226
24	133	300	408	533	675	833	1,200	1,633	1,875	2,133
25	128	288	392	512	648	800	1,152	1,568	1,800	2,048
26	123	277	377	492	623	769	1,107	1,507	1,730	1,969
27	119	267	363	474	600	740	1,066	1,451	1,666	1,896
28	114	257	350	457	578	714	1,028	1,400	1,607	1,828
30	107	240	326	426	540	667	960	1,306	1,500	1,706
32	100	225	306	400	506	625	900	1,225	1,406	1,600
34				376	476	588	847	1,153	1,323	1,506
36				355	450	555	800	1,088	1,250	1,422
38				337	426	526	757	1,031	1,184	1,347
40				320	405	500	720	980	1,125	1,280

The loads shown are based on 1,800 psi structural lumber per inch of width.

For 1,600 psi use 89 per cent of loads shown.

For 1,400 psi use 78 per cent of loads shown.

For 1,200 psi use 66 per cent of loads shown.

For 1,000 psi use 55 per cent of loads shown.

*These figures are for lumber on edge—simple end supported. For other thicknesses, multiply above load by the actual thickness.

7.11 SAFE LOADS FOR TIMBER COLUMNS

Size of post, in.	Length of post							
	8 ft	10 ft	12 ft	14 ft	16 ft	18 ft	20 ft	22 ft
	Safe load, lb							
4 × 4	12,109	7,794	5,412	3,976	3,044			
5 × 5	23,980	18,920	13,214	9,708	7,433	5,783	4,757	
6 × 6	37,145	33,660	27,245	20,131	15,412	12,178	9,864	
8 × 8	68,992	67,021	63,430	57,517	48,435	38,488	31,175	25,764
10 × 10	110,000	107,800	105,600	101,750	95,920	87,450	75,680	62,902
12 × 12		158,400	155,232	152,698	148,579	142,718	134,640	123,552
14 × 12			215,600	211,288	208,485	204,173	198,352	189,728
16 × 16				281,600	275,968	278,870	268,083	261,888
18 × 18					356,400	349,272	346,064	340,718
20 × 20						440,000	431,200	427,240

The figures are based on 1,100 psi compressive strength lumber. Columns are standing plumb and supported at ends only.

For 1,000 psi use 91 per cent of loads shown.

For 1,200 psi use 109 per cent of loads shown.

For 1,400 psi use 127 per cent of loads shown.

For 1,600 psi use 145 per cent of loads shown.

Safe Capacity of Spruce Timbers Used as Gin Poles

Section, in.	Length, ft	Safe capacity, tons
6 × 6	20	7
6 × 6	25	5
6 × 6	30	3
8 × 8	25	16
8 × 8	30	12
8 × 8	35	9
8 × 8	40	5
8 × 8	45	2
10 × 10	25	30
10 × 10	30	25
10 × 10	35	20
10 × 10	40	16
10 × 10	45	12
10 × 10	50	8
12 × 12	30	40
12 × 12	40	30
12 × 12	50	20
12 × 12	60	10

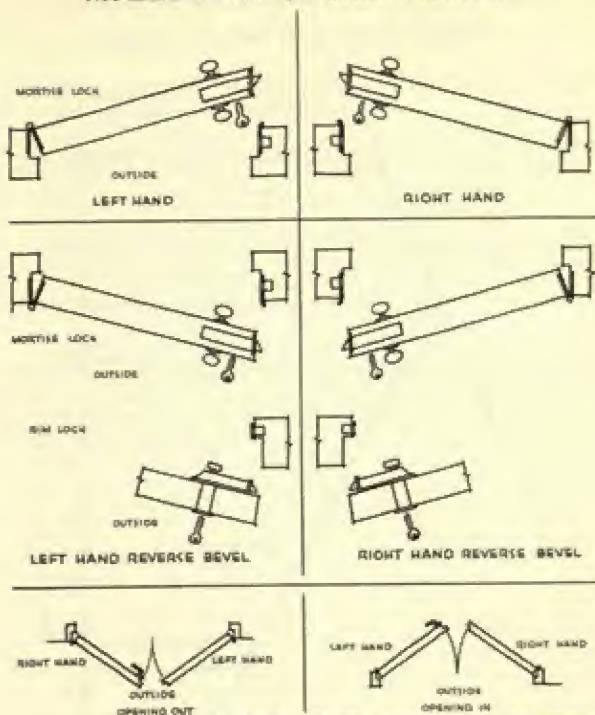
7.12 DOUGLAS FIR PLYWOOD (INTERIOR TYPE)—Standard stock sizes

Grade	Width, in.	Length, in.	Thickness, in.			
A-A	36	72 96	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4
A-A	48	72 84 96 108 120 144	1/4 1/2 3/4 1/2 1/2 1/2	1/4 1/2 3/4 1/2 1/2 1/2	1/4 1/2 3/4 1/2 1/2 1/2	1/4 1/2 3/4 1/2 1/2 1/2
A-B	36	96	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4
A-B	48	72 84 96 108 120 144	1/4 1/2 3/4 1/2 1/2 1/2	1/4 1/2 3/4 1/2 1/2 1/2	1/4 1/2 3/4 1/2 1/2 1/2	1/4 1/2 3/4 1/2 1/2 1/2
A-D	30	60 72 84 96 120	1/4 1/2 3/4 1/2 1/2	1/4 1/2 3/4 1/2 1/2	1/4 1/2 3/4 1/2 1/2	1/4 1/2 3/4 1/2 1/2
A-D	36	60 72 84 96 120	1/4 1/2 3/4 1/2 1/2	1/4 1/2 3/4 1/2 1/2	1/4 1/2 3/4 1/2 1/2	1/4 1/2 3/4 1/2 1/2
A-D	48	60 72 84 96 108 120 144	1/4 1/2 3/4 1/2 1/2 1/2 1/2	1/4 1/2 3/4 1/2 1/2 1/2 1/2	1/4 1/2 3/4 1/2 1/2 1/2 1/2	1/4 1/2 3/4 1/2 1/2 1/2 1/2
B-B (concrete form)	48	96	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4
B-D	48	84 96	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4
C (repaired)-D (underlayment)	48	96	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4
C-D (sheathing) unsanded	48	96 120	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4	1/4 1/2 3/4

7.13 DOUGLAS FIR PLYWOOD (EXTERIOR TYPE)—Standard stock sizes

Grade	Width, in.	Length, in.	Thickness, in.						
A-A	48	60 84 96 108 120 144	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	1
A-B	48	84 96 120 144	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$	1
A-C	36	96	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	
A-C	48	72 84 96 108 120 144	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$	
B-B(concrete form)	48	96				$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	
C(repai red)-C(under- lay ment)	48	96	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	
C-C(sheathing) un- sanded	48	96	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	
Overlaid plywood:									
A-A(high density)	36	96	$\frac{3}{8}$						
	48	96	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	1 $\frac{1}{8}$
B-B(high density)	36	96	$\frac{3}{8}$						
	48	96	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	1 $\frac{1}{8}$
B-B(high density, concrete form)	48	96		$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$		
B-B(medium density)	36	96	$\frac{3}{8}$						
	48	96	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	1 $\frac{1}{8}$
B-B(medium density)	48	96		$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$		

7.14 HAND OF DOORS; CASEMENT WINDOWS



CASEMENT WINDOWS - SPECIFY WHETHER IN OR OUT-OPENING
 ALSO APPLIES TO CRAWLING DOOR

NOTE - THESE CONVENTIONS ARE EXACTLY OPPOSITE TO THOSE FOLLOWED BY THE METAL WINDOW INSTITUTE



CUPBOARDS, CABINETS, BOOKCASES
 NOTE - REVERSIBLE DOORS FOLLOW THESE CONVENTIONS



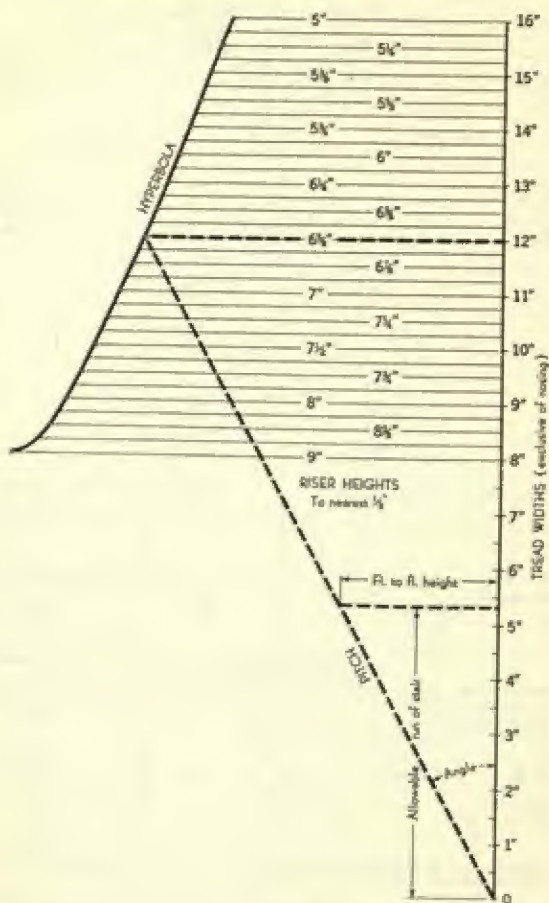
STANDARD BEVEL

Prepared by Seymour Howard, architect and associate professor at Pratt Institute, with the cooperation of the American Society of Architectural Hardware Consultants.

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7.15 PROPORTIONAL TREAD AND RISER DIAGRAM

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7.15 PROPORTIONAL TREAD AND RISER DIAGRAM (Cont.)

TO USE THIS CHART

1. To find proper riser for a given tread: Read tread line to given width and select riser at intersection.
2. To find proper tread for a given riser: Select riser to nearest $\frac{1}{4}$ " and read tread width to nearest $\frac{1}{4}$ " (or nearest $\frac{1}{8}$ " by interpolation) at intersection with tread line.
3. To find tread and riser for given height and run of stair: Scale run of stair on tread line. Draw fl. to fl. height at same scale. Draw pitch of stair. Where pitch intersects hyperbola, measure riser to tread line. Read tread width directly.
4. To find run of stair for given height, tread and riser: Select riser. Connect intersection at hyperbola with 0 on tread line, establishing pitch. Draw fl. to fl. height to scale, intersecting pitch and perpendicular to tread line. Run is found at same scale as height on tread line from 0 to intersection of fl. to fl. height.

7.16 STAIRS

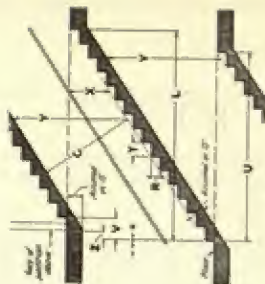
Purpose

Given on this page are data on critical dimensions and clearances controlling the layout of non-winder stairways of all except circular types. Material was developed by Raymond Baxter Eaton.

Stair Table

Dimensions indicated on the accompanying diagram and listed in the table determine the vertical and horizontal areas and headroom clearances for stair systems with tread and riser proportions shown. They can be used directly in developing sketches or working drawings and eliminate the need for experimental stair plans or sections. All dimensions refer to face of treads without nosing.

Tabular data refer only to minimum conditions for straight-run stairs. All figures may be adjusted according to requirements of design or stair use.



STAIR TABLE.....Dimensions in feet and inches

Floor to Floor Height	No. of Rises	Riser R	Tread T	Total Run L	Min. Headroom Y	Handed X	Clearance C	Partitions Above Z*	Foot Riser	
									Below - U	Above - V*
8'-0"	11	8.73"	8 1/2"	6'-10 1/2"	8'-2"	2'-10"	5'-8"	-1'-10"	8'-6"	-1'-2"
	12	8.00	9	8'-3"	7'-10"	2'-9 1/4	5'-10 1/4	-1'-8 1/4	9'-7 1/4	-1'-4"
	13	7.38	10 1/4	10'-3"	7'-7"	2'-9	6'-2"	-1'-6 1/4	11'-0"	-1'-5 1/4
	14	6.76	11 1/4	12'-6 1/4	7'-4"	2'-8	6'-4"	-1'-7"	13'-6 1/4	-9 1/4
	15	6.40	12 1/4	14'-7"	7'-3"	2'-9	6'-7 1/4	-1'-6 1/4	15'-5 1/4	-7 1/4
	16	6.00	13 1/4	16'-10 1/4	7'-3"	2'-9	6'-7 1/4	-1'-9	17'-6	-8
8'-6"	12	8.50	8 1/2	7'-9 1/4	8'-1"	2'-9 1/4	5'-8 1/4	-1'-3 1/4	8'-10	-11
	13	7.85	9 1/4	9'-3"	7'-9"	2'-9 1/4	5'-10 1/4	-1'-1"	9'-10	-7 1/4
	14	7.29	10 1/4	11'-4 1/4	7'-6"	2'-9	6'-2"	-10 1/4	12'-0	-4
	16	6.60	11 1/4	13'-8 1/4	7'-4"	2'-9	6'-4"	-7	13'-10	-1 1/4
	18	6.38	12 1/4	15'-7 1/4	7'-3"	2'-9	6'-5 1/4	-7	15'-5 1/4	+3 1/4
	17	6.00	13 1/4	18'-0"	7'-3"	2'-9	6'-7"	-7	17'-8	+5
9'-0"	12	9.00	8	7'-4"	8'-3"	2'-10	5'-6	-11	8'-1	-8
	13	8.31	8 1/2	8'-6"	8'-0"	2'-9 1/4	5'-9	-9	8'-11 1/4	-5
	14	7.71	9 1/4	10'-2 1/4	7'-9"	2'-9 1/4	6'-0	-8	10'-8	-4
	16	7.20	10 1/4	12'-3"	7'-6"	2'-9	6'-2 1/4	-8	11'-10	+4 1/4
	18	6.78	11 1/4	14'-6 1/4	7'-4"	2'-9	6'-4"	+2	13'-11	+1'-0
	17	6.35	12 1/4	16'-8"	7'-3"	2'-9	6'-5 1/4	+5	15'-5 1/4	+1'-4
9'-6"	18	6.00	13 1/4	19'-1 1/4	7'-3"	2'-9	6'-7 1/4	+6	17'-8	+1'-6
	13	8.77	8	8'-0"	8'-2"	2'-10	5'-8 1/4	-10 1/4	8'-2	-4
	14	8.14	9	9'-9"	7'-10"	2'-9 1/4	5'-9 1/4	-9	9'-5 1/4	+5
	16	7.60	10 1/4	11'-4 1/4	7'-7"	2'-9	6'-1 1/4	+4 1/4	10'-7	+10 1/4
	18	7.18	11 1/4	13'-8 1/4	7'-6"	2'-9	6'-2"	+6 1/4	12'-2	+1'-6 1/4
	17	6.71	12 1/4	16'-8"	7'-4"	2'-9	6'-4"	+1'-1 1/4	13'-10 1/4	+1'-11
9'-6"	18	6.33	13 1/4	17'-8 1/4	7'-3"	2'-9	6'-5 1/4	+1'-5 1/4	15'-7	+2'-4
	19	6.00	14 1/4	20'-3"	7'-3"	2'-9	6'-8	+1'-8	17'-9	+2'-7 1/4

7.16 STAIR TABLE (In Feet and Inches) (Cont.)

Floor to Floor Height	No. of Risers	Riser R	Tread T	Total Run L	Min. Headroom Y	Handrail X	Clearance C	Partitions Above Z*	First Riser	
									Below U	Above V*
10'-0"	14	8.57	8 1/2	9'-2 1/2	8-1	2'-9 1/2	5'-8 1/2	* 2	8-8	* 6
	15	8.00	9	10'-6	7-10	2'-9 1/2	5'-10 1/2	* 6 1/2	9-7	* 11
	16	7.60	10	12'-0	7-7	2'-9	6-1	* 1-1	10-11 1/2	* 1-6 1/2
	17	7.06	11	14'-0	7-8	2'-8	6'-2 1/2	* 1-7 1/2	12'-8 1/2	* 2'-2 1/2
	18	6.87	12	17'-0	7-4	2'-6	6-8	* 2-0	14'-3 1/2	* 2'-8
10'-6"	19	6.32	12 1/2	18'-9	7-3	2'-9	6-5	* 2-5	15-8	* 3-2 1/2
	20	6.00	13 1/2	21'-4 1/2	7-3	2'-9	6-7 1/2	* 2-10	17'-9	* 3-8 1/2
	14	9.00	8	8-8	8-3	2'-10	5'-2 1/2	* 6	8-0	* 9
	15	8.60	8 1/2	9-11	8-1	2'-9 1/2	5'-8 1/2	* 5 1/2	8-10	* 1-1
	16	7.88	9 1/2	11'-6 1/2	7-9	2'-9 1/2	5'-10 1/2	* 1-3 1/2	9-10	* 1-8 1/2
10'-6"	17	7.41	10	13'-4	7-7	2'-9	6-1	* 1-9 1/2	11-0	* 2-2 1/2
	18	7.00	11	15'-7	7-8	2'-8	6'-2 1/2	* 2-6	12'-7 1/2	* 3-0 1/2
	19	6.63	12	18'-0	7-4	2'-6	6-4 1/2	* 2-11	14-4	* 3-8 1/2
	20	6.35	12 1/2	21'-9 1/2	7-3	2'-9	6-6	* 3-5 1/2	15-7	* 4-2 1/2
	21	6.00	13 1/2	25'-6	7-3	2'-9	6-7 1/2	* 4-0	17'-9	* 5-0
11'-0"	15	8.80	8	9'-4	8-2	2'-10	5'-6	* 1-0 1/2	8-1	* 1-2 1/2
	16	8.25	8 1/2	10-11 1/2	8-0	2'-9 1/2	5-10	* 1-5	9-2 1/2	* 1-9
	17	7.78	9 1/2	12'-8	7-9	2'-9 1/2	6-0	* 2-0	10-9 1/2	* 2-4 1/2
	18	7.33	10 1/2	14'-8 1/2	7-8	2'-9	6-1 1/2	* 2-7 1/2	11-4 1/2	* 3-1 1/2
	19	6.88	11	16'-8	7-8	2'-8	6-3	* 3-3	12-8	* 3-8
11'-0"	20	6.40	12	18'-0	7-4	2'-8	6-6	* 3-10 1/2	14-6 1/2	* 4-7 1/2
	21	6.29	12 1/2	20-10	7-3	2'-9	6-8	* 4-5	15-8	* 5-3
	22	6.00	13 1/2	23'-7 1/2	7-3	2'-9	6-7 1/2	* 5-1	17'-8	* 6-0

Notes: Figures in bold face indicate units recommended for most locations.

* Indicates stairs allowable only for exits and egress but not recommended.

Δ Indicates steps for exterior or non-slip use.

• Dimensions given plus or minus 1/4 inch unless noted.

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SECTION VIII

Roofing and Siding

8.1 CEDAR SHINGLES FOR ROOFS

Four-bundle squares used for roofs only.

Exposure, in.	Shingles		
	16 in.	18 in.	24 in.
	Covering capacity of 1 square (4 bundles), sq ft		
3½	72	62	
4	80	70	
4½	90	80	
5	100	90	
5½	110	100	
6	127	110	80
6½	134	118	90
7	140	126	95
7½	150	136	100
8	160	146	106
8½	170	156	113
9	180	164	120
9½	190	174	127
10	200	184	133
10½	208	192	140
11	218	202	147
11½	226	210	153
12	238	220	160
12½		230	166
13		238	172
13½		248	180
14		258	186
14½			192
15			200
15½			206
16			212

To cover 100 sq ft, use one square of 16-in. shingles laid at 5-in. exposure, one square of 18-in. shingles laid at 5½-in. exposure, or one square of 24-in. shingles laid at 7½-in. exposure.

8.2 CEDAR SHINGLES FOR SIDE WALLS

Three-bundle squares used for side walls only.

Exposure, in.	Shingles		
	16 in.	18 in.	24 in.
	Covering capacity of 1 square (3 bundles), sq ft		
3½	54		
4	60	52½	
4½	67½	60	
5	75	67½	
5½	82½	75	
6	96	82½	
6½	100	88½	
7	105	94½	
7½	112½	100	75
8	120	109½	79½
8½	127½	117	84½
9	135	123	90
9½	142½	130½	95
10	150	138	100
10½	156	144	105
11	163½	151½	110
11½	169½	157½	114½
12	178	165	120
12½		172½	124½
13		173½	129
13½		186	135
14		193½	139½
14½			144
15			150
15½			154½
16			159

To cover 100 sq ft, use a 3-bundle square of 16-in. shingles laid at 6½-in. exposure, a 3-bundle square of 18-in. shingles laid at 7½-in. exposure, or a 3-bundle square of 24-in. shingles laid at 10-in. exposure.

8.3 ASPHALT SHINGLES

Type	Size, in.	Weight per square, lb	Headlap, in.	Exposure, in.	Shingles per square	Bundles per square	Nails per square, lb-oz
2 tab	36 × 15	300	5	5	80	4	1-4
	36 × 12	325	2	5	80	4	1-4
3 tab	36 × 12	290	2	5	80	4	1-4
	36 × 12	275	2	5	80	3	1-4
	36 × 12	255	2	5	80	3	1-4
	36 × 12	220	2	5	80	3	1-4
	36 × 12	215	2	5	80	3	1-4
	36 × 10	190	2	4	100	3	1-6
	36 × 11½	167	2	4½	86	2	1-3
	16 × 12	162	Head 2, side 3	10 × 13 13½ × 13½	113	2	1-8
Single hexagonal	16 × 16	162			82	2	2-0

8.4 ASBESTOS SIDING AND SHINGLES

Type	Size, in.	Weight per square, lb	Headlap, in.	Exposure, in.	Pieces per square	Bundles per square	Nails per square, lb-oz
Siding	24 × 12	175	1	24 × 11	54	3	1-6
	24 × 12	185	1½	24 × 10½	54	3	1-6
	32 × 9½	205	1	32 × 8½	52	3	1-8
	24 × 12	165	1½	24 × 10½	57	3	1-8
Siding Dutch lap	16 × 16	280	Head 3, side 4	12 × 13	92	4	1-8
	16 × 16	260	Side 3	13 × 13	86	4	1-8
Roofing: 3 tab hexagonal Dutch lap singles	30 × 14	310	2	6	80	5	1-10
	16 × 16	245	3	13 × 13	86	4	1-8
	16 × 16	260	Head 3, side 4	12 × 13	92	4	1-8
	8 × 16	540	2	7	260	8	3-0

Corrugated Asbestos

The standard sizes of sheets are 3 to 11 ft long (in 6-in. increments) by 3 ft 6 in. wide. The weight is 3.7 to 4.1 lb per sq ft.

8.5 CORRUGATED STEEL SIDING AND ROOFING

Type	Gauge	Width, in.		Weight per 100 sq ft, lb
		Full	Coverage	
Roofing, 2½-in. corrugated	18	33	29	251
	20	33	29	196
	22	33	29	169
	24	33	29	143
Roofing V-Beam*	18	29	26½	286
	20	29	26½	225
	22	29	26½	193
	24	29	26½	162
Roofing, mansard*	20	32½	29½	196
	22	32½	29½	169
	24	32½	29½	143
Siding 2½-in. corrugated	18	34	31½	244
	20	34	31½	191
	22	34	31½	164
	24	34	31½	138
Siding, fluted 1½-in. pitch	18		25½	282
	20		25½	212
	22		25½	176
Roofing, fluted 1½-in. pitch	18		25½	300
	20		25½	225
	22		25½	188
Roofing, fluted 1¼-in. pitch	18		25¼	320
	20		25¼	240
	22		25¼	200

*Siding sheets are identical.

8.6 SLATE ROOFS

Slate size, in.	Pieces per square	Exposure using a 3-in. lap, in.	3d nails per square, lb-oz
26 × 14	89	11½	1-0
24 × 16	86	10½	1-0
24 × 14	98	10½	1-2
24 × 13	106	10½	1-3
24 × 11	125	10½	1-7
24 × 12	114	10½	1-5
22 × 14	108	9½	1-4
22 × 13	117	9½	1-5
22 × 12	126	9½	1-7
22 × 11	138	9½	1-9
22 × 10	152	9½	1-12
20 × 14	121	8½	1-6
20 × 13	132	8½	1-8
20 × 12	141	8½	1-10
20 × 11	154	8½	1-12
20 × 10	170	8½	1-15
20 × 9	189	8½	2-3
18 × 14	137	7½	1-9
18 × 13	148	7½	1-11
18 × 12	160	7½	1-13
18 × 11	175	7½	2-0
18 × 10	192	7½	2-3
18 × 9	213	7½	2-7
16 × 14	160	6½	1-13
16 × 12	184	6½	2-2
16 × 11	201	6½	2-5
16 × 10	222	6½	2-8
16 × 9	246	6½	2-13
16 × 8	277	6½	3-2
14 × 12	218	5½	2-8
14 × 11	238	5½	2-11
14 × 10	261	5½	3-3
14 × 9	291	5½	3-5
14 × 8	327	5½	3-12
14 × 7	374	5½	4-4
12 × 10	320	4½	3-10
12 × 9	355	4½	4-1
12 × 8	400	4½	4-9
12 × 7	457	4½	5-3
12 × 6	533	4½	6-1
11 × 8	450	4	5-2
11 × 7	515	4	5-14
10 × 8	515	3½	5-14
10 × 7	586	3½	7-4
10 × 6	686	3½	7-13

Courtesy Buckingham—Virginia Slate Corp.

8.7 INSULATION

Asbestos-faced Insulated Board

Standard length, ft*	Thickness, in.	Weight per sq ft, lb
6, 8, 9, 10, 12	$\frac{3}{4}$	3.5
6, 8, 9, 10, 12	$1\frac{1}{8}$	3.8
6, 7, 8, 9, 10, 12	$1\frac{3}{16}$	4.7
6, 8, 9, 10, 12	2	5.4

Insulated board may be supplied cut to size at extra cost.

*All sheets are 4 ft wide.

Wool Batts

Size, in.	Batts per 100 sq ft of Wall
15 × 24	38
15 × 48	19
19 × 24	30
19 × 48	15
23 × 24	25
23 × 48	12½

All sizes come in 2-in. and 3-in. thicknesses.

Weight varies from 4½ to 5 lb per cubic foot.

Mineral Wool Blanket*

Thickness, in.	Widths, in.	Lengths, ft
$1\frac{1}{2}$	11, 15, 19, 23	4, 8
2	11, 15, 19, 23	2, 4, 8
3	11, 15, 19, 23	2, 4, 8
4	15, 19, 23	4
6	15, 19, 23	4

*Weight is 2½ to 3 lb per cubic foot.

Covering Capacity of Blanket*

Width, in.	Length		
	2 ft	4 ft	8 ft
	Covering capacity, sq ft		
11	2	4	8
15	2½	5½	10½
19	3½	6½	13½
23	4	8	16

*Measure to gross area of wall.

8.7 INSULATION (Cont.)

Fiber Glass

Thickness, in.	Width, in.	Length (rolls), ft-in.	Area per roll, sq ft	Area per bag, sq ft *
1 $\frac{1}{4}$	15	80-0	100	400
1 $\frac{1}{2}$	23	65-3	125	500
2 $\frac{1}{4}$	15	60-0	75	300
2 $\frac{1}{2}$	23	52-2	100	400
3	15	40-0	50	200
3	23	39-2	75	300

*4 rolls per bag.

8.8 ALUMINUM SHEETS, PLATES, AND SIDING

Sheets

Thickness, in.	B.&S. gauge	Weight, lb per sq ft	Sheet size, in.					
			24×72	36×96	36×120	36×144	48×120	48×144
			Weight per sheet, lb					
0.020	24	0.282	3.38	6.77	8.46	10.2	11.3	13.5
0.025	22	0.353	4.24	8.47	10.6	12.7	14.1	16.9
0.032	20	0.452	5.42	10.8	13.6	16.3	18.1	21.7
0.040	18	0.564	6.77	13.5	16.9	20.3	22.6	27.1
0.051	16	0.720	8.64	17.3	21.6	25.9	28.8	34.6
0.064	13	0.903	10.8	21.7	27.1	32.5	36.1	43.3

Plates

Thickness, in.	B.&S. gauge, in.	Weight, lb per sq ft	Sheet size, in.					
			24×72	36×96	36×120	36×144	48×120	48×144
			Weight per sheet, lb					
0.250	$\frac{1}{4}$	3.53	42.4	84.7	106.0	127.0	141.0	169.0
0.375	$\frac{3}{8}$	5.29	63.5	127.0	159.0	190.0	212.0	249.0
0.500	$\frac{1}{2}$	7.06	84.7	169.0	212.0	254.0	282.0	339.0

Siding and Roofing

Type	Pitch, in.	Size of sheet			Thickness, in.	Weight per 100 sq ft, lb
		Length, ft	Widths, in.			
			Full	Lays (net)		
Ribbed	4	5-30	41 $\frac{1}{2}$	40	0.032	58.0
					0.040	72.5
	5.33	5-12	34 $\frac{1}{2}$	32	0.032	63.0
	8	5-30	41 $\frac{1}{2}$	40	0.032	51.8
					0.040	64.7
V-Beam	4 $\frac{1}{2}$	5-12	41 $\frac{1}{4}$	39	0.040	75.0
					0.050	92.3
Corrugated	2.67	5-12	33 $\frac{1}{2}$	32	0.024	41.0
			47 $\frac{1}{2}$	45 $\frac{1}{2}$		
		5-30	33 $\frac{1}{2}$	32	0.032	55.0
			47 $\frac{1}{2}$	45 $\frac{1}{2}$		

All lengths are in 6-in. increments.

SECTION IX

Steel and Iron

9.1 WELDING SYMBOLS (American Institute of Steel Construction)

ARC AND GAS WELDING SYMBOLS										
TYPE OF WELD										
BEAD	FILLET	GROOVE					PLUS & SLOT	FIELD WELD	WELD ALL AROUND	FLUSH
		SQUARE	V	BEVEL	U	J				
LOCATION OF WELDS										
ARROW (OR NEAR) SIDE OF JOINT			OTHER (OR FAR) SIDE OF JOINT			BOTH SIDES OF JOINT				
<ol style="list-style-type: none"> 1. THE SIDE OF THE JOINT TO WHICH THE ARROW POINTS IS THE ARROW (OR NEAR) SIDE AND THE OPPOSITE SIDE OF THE JOINT IS THE OTHER (OR FAR) SIDE. 2. ARROW SIDE AND OTHER SIDE WELDS ARE SAME SIZE UNLESS OTHERWISE SHOWN. 3. SYMBOLS APPLY BETWEEN ABRUPT CHANGES IN DIRECTION OF JOINT OR AS DIMENSIONED (EXCEPT WHERE ALL AROUND SYMBOL IS USED). 4. ALL WELDS ARE CONTINUOUS AND OF USER'S STANDARD PROPORTIONS, UNLESS OTHERWISE SHOWN. 5. TAIL OF ARROW USED FOR SPECIFICATION REFERENCE (TAIL MAY BE OMITTED WHEN REFERENCE NOT USED.) E.G. "C. A."—AUTOMATIC SHIELDED CARBON ARC "S. A."—AUTOMATIC SUBMERGED ARC 6. IN JOINTS IN WHICH ONE MEMBER ONLY IS TO BE GROOVED, ARROW POINTS TO THAT MEMBER 7. DIMENSIONS OF WELD SIZES, INCREMENT LENGTHS, AND SPACINGS, IN INCHES. 										

The above symbols were developed by the American Welding Society for incorporation on drawings specifying arc or gas welding. For more detailed instruction in the use of these symbols refer to "Welding Symbols and Instructions for Their Use," published by the American Welding Society.

These symbols do not explicitly provide for the case that frequently occurs in structural work where duplicate material (such as stiffeners) occurs on the far side of a web or gusset plate. The fabricating industry has adopted this convention: when the billing of the detail material discloses the identity of far side with near side, the welding shown for the near side shall also be duplicated on the far side.

9.2 WIRE GAUGES

U.S.S. gauge No.	Diameter, in.	
	Decimal	Fraction
0000	0.3938	$\frac{11}{28}$
000	0.3625	$\frac{1}{2}$
00	0.3310	$\frac{11}{33}$
0	0.3065	$\frac{11}{36}$
1	0.2830	$\frac{11}{39}$
2	0.2625	$\frac{5}{19}$
3	0.2437	$\frac{1}{4}$
4	0.2253	$\frac{11}{49}$
5	0.2070	$\frac{1}{5}$
6	0.1920	$\frac{1}{5}$
7	0.1770	$\frac{11}{62}$
8	0.1620	$\frac{1}{6}$
9	0.1483	$\frac{5}{34}$
10	0.1350	$\frac{1}{7}$
11	0.1205	$\frac{1}{8}$
12	0.1055	$\frac{1}{9}$
13	0.0915	$\frac{1}{11}$
14	0.0800	$\frac{1}{12}$
15	0.0720	$\frac{1}{14}$
16	0.0625	$\frac{1}{16}$
17	0.0540	
18	0.0475	$\frac{1}{21}$
19	0.0410	
20	0.0348	
21	0.0317	$\frac{1}{32}$

9.3 WEIGHTS OF STEEL SHEETS

U.S.S. gauge	Thickness, in.	Weight per sq ft, lb	
		Cold rolled	Galvanized
7	0.1793	7.500	
8	0.1644	6.875	
9	0.1494	6.250	
10	0.1345	5.625	5.781
11	0.1196	5.000	5.156
12	0.1046	4.375	4.531
13	0.0897	3.750	3.906
14	0.0747	3.125	3.281
15	0.0673	2.812	2.969
16	0.0598	2.500	2.656
17	0.0538	2.250	2.406
18	0.0478	2.000	2.156
19	0.0418	1.750	1.906
20	0.0359	1.500	1.656
21	0.0329	1.375	1.531
22	0.0299	1.250	1.406
23	0.0269	1.125	1.281
24	0.0239	1.000	1.156
25	0.0209	0.875	1.031
26	0.0179	0.750	0.906
27	0.0164	0.688	0.844
28	0.0149	0.625	0.781
29	0.0135	0.563	0.719
30	0.0120	0.500	0.656

9.4 WEIGHT OF STEEL PLATES

Thickness, in.	Weight per lin ft, lb		
	1" wide	6" wide	12" wide (1 sq ft)
$\frac{1}{16}$	0.2125	1.257	2.55
$\frac{1}{8}$	0.4250	2.55	5.10
$\frac{3}{16}$	0.6375	3.83	7.65
$\frac{1}{4}$	0.8500	5.10	10.20
$\frac{5}{16}$	1.0600	6.36	12.72
$\frac{3}{8}$	1.2750	7.65	15.30
$\frac{7}{16}$	1.4880	8.93	17.86
$\frac{1}{2}$	1.7000	10.20	20.40
$\frac{9}{16}$	1.9130	11.48	22.96
$\frac{5}{8}$	2.1250	12.75	25.50
$\frac{11}{16}$	2.338	14.03	28.06
$\frac{3}{4}$	2.550	15.30	30.60
$\frac{13}{16}$	2.7630	16.58	33.16
$\frac{7}{8}$	2.9750	17.85	35.70
$\frac{15}{16}$	3.1880	19.13	38.26
1	3.400	20.40	40.80
$1\frac{1}{16}$	3.613	21.68	43.36
$1\frac{1}{8}$	3.825	22.95	45.90
$1\frac{1}{4}$	4.038	24.23	48.46
$1\frac{1}{2}$	4.250	25.50	51.00
$1\frac{3}{8}$	4.463	26.78	53.56
$1\frac{1}{2}$	4.675	28.05	56.10
$1\frac{5}{8}$	4.888	29.33	58.66
$1\frac{3}{4}$	5.100	30.60	61.20
$1\frac{7}{8}$	5.313	31.88	63.76
$1\frac{9}{8}$	5.525	33.15	66.30
$1\frac{11}{8}$	5.738	34.43	68.86
$1\frac{5}{4}$	5.950	35.70	71.40
$1\frac{13}{8}$	6.163	36.98	73.96
$1\frac{3}{2}$	6.375	38.25	76.50
$1\frac{15}{8}$	6.588	39.53	79.06
2	6.800	40.80	81.60
$2\frac{1}{8}$	7.225	43.35	86.50
$2\frac{1}{4}$	7.650	45.90	91.80
$2\frac{3}{8}$	8.075	48.45	96.90

9.4 WEIGHT OF STEEL PLATES (Cont.)

Thickness, in.	Weight per lin ft, lb		
	1" wide	6" wide	12" wide (1 sq ft)
2 ¹ / ₈	8.500	51.00	102.00
2 ¹ / ₄	8.925	53.55	107.10
2 ³ / ₈	9.350	56.10	112.20
2 ¹ / ₂	9.775	58.65	117.30
3	10.200	61.20	122.40
4	13.60	81.60	163.20
5	17.00	102.00	204.00
6	20.40	122.40	244.80
7	23.80	142.80	285.60
8	27.20	163.20	326.40
9	30.60	183.60	367.20
10	34.00	204.00	408.00
11	37.40	224.40	448.80
12	40.80	244.80	489.60

9.5 OPEN WEB STEEL JOISTS (SHORT SPANS)

Joist type	Depth, in.	Approx. weight per lin ft, lb
8 S 2	8	4.0
10 S 2	10	4.5
10 S 3	10	5.0
10 S 4	10	6.0
12 S 3	12	5.0
12 S 4	12	6.0
12 S 5	12	6.5
12 S 6	12	8.0
14 S 4	14	6.5
14 S 5	14	7.5
14 S 6	14	8.0
14 S 7	14	9.5
16 S 5	16	7.5
16 S 6	16	8.5
16 S 7	16	10.0
16 S 8	16	11.5
18 S 6	18	9.0
18 S 7	18	10.0
18 S 8	18	11.5
20 S 6	20	9.5
20 S 7	20	10.5
20 S 8	20	12.0
22 S 7	22	11.5
22 S 8	22	12.5
24 S 8	24	13.0

9.6 OPEN WEB JOISTS (LONG SPANS)

Joist type	Depth, in.	Approx. weight per lin ft, lb
18 L 02	18	13
18 L 03	18	14
18 L 04	18	16
18 L 05	18	17
18 L 06	18	19
18 L 07	18	21
18 L 08	18	23
18 L 09	18	25
18 L 10	18	27
18 L 11	18	29
18 L 12	18	31
20 L 03	20	14
20 L 04	20	16
20 L 05	20	17
20 L 06	20	19
20 L 07	20	21
20 L 08	20	23
20 L 09	20	25
20 L 10	20	27
20 L 11	20	29
20 L 12	20	31
20 L 13	20	36
24 L 04	24	16
24 L 05	24	17
24 L 06	24	19
24 L 07	24	21
24 L 08	24	23
24 L 09	24	25
24 L 10	24	27
24 L 11	24	29
24 L 12	24	31
24 L 13	24	36
24 L 14	24	38
28 L 06	28	19
28 L 07	28	21
28 L 08	28	23
28 L 09	28	25
28 L 10	28	27
28 L 11	28	29
28 L 12	28	31
28 L 13	28	36
28 L 14	28	39
28 L 15	28	43

SECTION X

Piping

10.1 STANDARD BLACK GALVANIZED PIPE (PLAIN ENDS)

Size, in.	Outside dia., in.	Wall thickness, in.	Inside dia., in.	Weight per lin ft, lb
$\frac{1}{8}$	0.405	0.068	0.269	0.24
$\frac{1}{4}$	0.540	0.088	0.364	0.42
$\frac{3}{8}$	0.675	0.091	0.493	0.57
$\frac{1}{2}$	0.840	0.109	0.622	0.85
$\frac{3}{4}$	1.050	0.113	0.824	1.13
1	1.315	0.133	1.049	1.68
$1\frac{1}{4}$	1.660	0.140	1.380	2.27
$1\frac{1}{2}$	1.900	0.145	1.610	2.72
2	2.375	0.154	2.067	3.65
$2\frac{1}{2}$	2.875	0.203	2.469	5.79
3	3.500	0.218	3.068	7.58
$3\frac{1}{2}$	4.000	0.226	3.548	9.11
4	4.500	0.237	4.026	10.79
5	5.563	0.258	5.047	14.62
6	6.625	0.280	6.065	18.97

Courtesy United States Steel Corp.

10.2 EXTRA-HEAVY BLACK GALVANIZED PIPE (PLAIN ENDS)

Size, in.	Outside dia., in.	Wall thickness, in.	Inside dia., in.	Weight per lin ft, lb
$\frac{1}{8}$	0.405	0.095	0.215	0.31
$\frac{1}{4}$	0.540	0.119	0.302	0.54
$\frac{3}{8}$	0.675	0.126	0.423	0.74
$\frac{1}{2}$	0.840	0.147	0.546	1.09
$\frac{3}{4}$	1.050	0.154	0.742	1.47
1	1.315	0.179	0.957	2.17
$1\frac{1}{4}$	1.660	0.191	1.278	3.00
$1\frac{1}{2}$	1.900	0.200	1.500	3.63
2	2.375	0.218	1.939	5.02
$2\frac{1}{2}$	2.875	0.276	2.323	7.66
3	3.500	0.300	2.900	10.25
$3\frac{1}{2}$	4.000	0.318	3.364	12.51
4	4.500	0.337	3.826	14.98
5	5.563	0.375	4.813	20.78
6	6.625	0.432	5.761	28.57
8	8.625	0.500	7.625	43.39

10.3 DOUBLE EXTRA-HEAVY BLACK GALVANIZED PIPE (PLAIN ENDS)

Size, in.	Outside dia., in.	Wall thickness, in.	Inside dia., in.	Weight per lin ft, lb
2	2.375	0.436	1.503	9.03
2½	2.875	0.552	1.771	13.70
3	3.500	0.600	2.300	18.58
4	4.500	0.874	3.152	27.54
5	5.563	0.750	4.063	38.55
6	6.625	0.864	4.897	53.16
8	8.625	0.875	6.875	72.42

Courtesy United States Steel Corp.

10.4 RED BRASS PIPE AND COPPER PIPE

Standard size, in.*	Diameter, in.		Wall thickness, in.	Weight per lin ft, lb	
	Outside	Inside		Red brass†	Copper
½	0.405	0.281	0.062	0.253	0.259
¾	0.540	0.357	0.082	0.447	0.457
1	0.675	0.494	0.090	0.627	0.641
1½	0.840	0.625	0.107	0.934	0.955
2	1.050	0.822	0.114	1.27	1.30
1	1.315	1.062	0.126	1.78	1.82
1½	1.660	1.368	0.146	2.63	2.69
2	1.900	1.600	0.150	3.13	3.20
2½	2.375	2.062	0.156	4.12	4.22
3	2.875	2.500	0.187	5.99	6.12
3	3.500	3.062	0.219	8.56	8.75
3½	4.000	3.500	0.250	11.2	11.4
4	4.500	4.000	0.250	12.7	12.9
5	5.562	5.062	0.250	15.8	16.2
6	6.625	6.125	0.250	19.0	19.4
8	8.625	8.000	0.312	30.9	31.6
10	10.750	10.019	0.365	45.2	46.2
12	12.750	12.000	0.375	55.3	56.5

S.P.S. (Standard Pipe Sizes) is for use with threaded fittings; for threadless pipe, see p. 223.

Courtesy American Brass Co.

*All are supplied in standard 12-ft lengths.

†Red brass is 85 per cent copper, 15 per cent zinc.

10.5 THREADLESS COPPER PIPE

Size, in.	Diameter, in.		Wall thickness, in.	Weight per lin ft, lb
	Outside	Inside		
$\frac{1}{8}$	0.340	0.410	0.065	0.376
$\frac{1}{4}$	0.675	0.545	0.065	0.483
$\frac{3}{8}$	0.840	0.710	0.065	0.613
$\frac{1}{2}$	1.050	0.920	0.065	0.780
1	1.315	1.185	0.065	0.989
$1\frac{1}{2}$	1.660	1.530	0.065	1.26
$1\frac{1}{2}$	1.900	1.770	0.065	1.45
2	2.375	2.245	0.065	1.83
$2\frac{1}{2}$	2.875	2.745	0.065	2.22
3	3.500	3.334	0.083	3.45
$3\frac{1}{2}$	4.000	3.810	0.095	4.52
4	4.500	4.286	0.107	5.72
5	5.562	5.298	0.132	8.73
6	6.625	6.309	0.158	12.4
8	8.625	8.215	0.205	21.0
10	10.750	10.238	0.256	32.7
12	12.750	12.124	0.313	47.4

Supplied in standard 20-ft lengths.
 Courtesy American Brass Co.

10.6 COPPER TUBING

Size, in.	Outside dia., in.	Wall thickness, in.				Weight per lin ft., lb.			
		K	L	M	DWV	K	L	M	DWV
	0.375	0.035	0.030	0.025		0.145	0.126	0.106	
	0.500	0.049	0.035	0.025		0.269	0.198	0.145	
	0.625	0.049	0.040	0.028		0.344	0.285	0.204	
	0.750	0.049	0.042			0.418	0.362		
	0.875	0.065	0.045	0.032		0.641	0.455	0.328	
1	1.125	0.065	0.050	0.035		0.839	0.655	0.465	
1 1/4	1.375	0.065	0.055	0.042	0.040	1.04	0.884	0.682	0.650
1 1/2	1.625	0.072	0.060	0.049	0.042	1.36	1.14	0.940	0.809
2	2.125	0.083	0.070	0.058	0.042	2.06	1.75	1.46	1.07
2 1/2	2.625	0.095	0.080	0.065		2.93	2.48	2.03	
3	3.125	0.109	0.090	0.072	0.045	4.00	3.33	2.68	1.69
3 1/2	3.625	0.120	0.100	0.083		5.12	4.29	3.58	
4	4.125	0.134	0.110	0.095	0.058	6.51	5.38	4.66	2.87
5	5.125	0.160	0.125	0.109	0.072	9.67	7.61	6.66	4.43
6	6.125	0.192	0.140	0.122	0.083	13.9	10.2	8.92	6.10
8	8.125	0.271	0.200	0.170		25.9	19.3	16.5	
10	10.125	0.388	0.250	0.212		40.3	30.1	25.6	
12	12.125	0.405	0.280	0.254		57.8	40.4	36.7	

Supplied in 20-ft straight lengths and in coils of 60 and 100 ft.
Courtesy American Brass Co.

10.7 WROUGHT-IRON PIPE

Standard Weight *

Size, in.	Outside dia., in.	Inside dia., in.	Weight per lin ft, lb†
$\frac{1}{8}$	0.540	0.360	0.42
$\frac{1}{4}$	0.675	0.489	0.57
$\frac{3}{8}$	0.840	0.617	0.85
$\frac{1}{2}$	1.050	0.819	1.13
1	1.315	1.043	1.68
$1\frac{1}{2}$	1.660	1.374	2.27
$1\frac{3}{4}$	1.900	1.604	2.72
2	2.375	2.060	3.65
$2\frac{1}{2}$	2.875	2.460	5.79
3	3.500	3.059	7.58
$3\frac{1}{2}$	4.000	3.538	9.11
4	4.500	4.016	10.79
5	5.563	5.036	14.62
6	6.625	6.053	18.97
8	8.625	8.059	24.70
8	8.625	7.967	28.55
10	10.750	10.181	31.20
10	10.750	10.124	34.24
10	10.750	10.005	40.48
12	12.750	12.077	43.77
12	12.750	11.985	49.56

*Standard-weight pipe is normally furnished in random lengths of 16 ft and over, with thread and coupling.

†Weight does *not* include coupling.

Courtesy A. M. Byers Co.

10.7 WROUGHT-IRON PIPE (Cont.)

Extra Strong*

Size, in.	Outside dia., in.	Inside dia., in.	Weight per lin ft, lb†
$\frac{1}{4}$	0.540	0.295	0.54
$\frac{3}{8}$	0.675	0.417	0.74
$\frac{1}{2}$	0.840	0.539	1.09
$\frac{3}{4}$	1.050	0.735	1.47
1	1.315	0.949	2.17
$1\frac{1}{4}$	1.660	1.269	3.00
$1\frac{1}{2}$	1.900	1.491	3.83
2	2.375	1.929	5.02
$2\frac{1}{2}$	2.875	2.311	7.06
3	3.500	2.887	10.25
$3\frac{1}{2}$	4.000	3.350	12.51
4	4.500	3.811	14.98
5	5.563	4.797	20.78
6	6.625	5.743	28.57
8	8.625	7.604	43.39
10	10.750	9.729	54.74
12	12.750	11.729	65.47

*Extra strong pipe is normally furnished in random lengths of 12 ft and over, plain ends.

†Weight does *not* include coupling.

Courtesy A. M. Byers Co.

10.8 POLYETHYLENE PIPE

Size, in.	Standard		Pressure rated at 75 lb		
	Outside dia., in.	Weight per lin ft, lb	Outside dia., in.	Weight per lin ft, lb	Length of coils, ft
$\frac{1}{2}$	0.840	0.103	0.782	0.070	400, 100
$\frac{3}{4}$	1.050	0.133	1.024	0.116	400, 100
1	1.315	0.196	1.300	0.184	300, 100
1 $\frac{1}{4}$	1.660	0.267	1.710	0.319	300, 100
1 $\frac{1}{2}$	1.900	0.318	2.000	0.441	250, 100
2	2.375	0.450	2.567	0.725	200, 100
2 $\frac{1}{2}$	2.875	0.694			100
3	3.500	0.890			100

Courtesy Mueller Brass Co.

10.9 CLAY SEWER PIPE

Size, in.	Weight per lin ft, lb		Crushing strength per lin ft, lb	
	Standard strength	Extra strength	Standard strength	Extra strength
4	7.5		1,000	
6	13.0	17.0	1,100	2,000
8	22.0	26.0	1,300	2,000
10	33.0	44.0	1,400	2,000
12	44.0	62.0	1,500	2,250
15	71.0	94.0	1,750	2,750
18	105.0	135.0	2,000	3,300
21	130.0	177.0	2,200	3,850
24	175.0	245.0	2,400	4,400
27	215.0	300.0	2,750	4,700
30	280.0	370.0	3,200	5,000
33	325.0		3,500	
36	345.0	435.0	3,900	6,000

Standard lengths vary (2, 2 $\frac{1}{2}$, 3, and 4 ft) according to manufacturer.

10.10 JUTE FOR JOINTING CLAY PIPE

Plain Vitrified Clay Pipe

Inside dia., in.	Weight of jute, lb	Inside dia., in.	Weight of jute, lb
4	0.05	21	0.53
6	0.08	24	0.83
8	0.19	27	1.11
10	0.23	30	1.42
12	0.27	33	1.58
15	0.33	36	2.72
18	0.38		

Bell and Spigot Clay Pipe

Pipe dia., in.	Jute required per joint, lb	Pipe dia., in.	Jute required per joint, lb
3	0.18	24	1.50
4	0.21	30	2.06
6	0.31	36	3.00
8	0.44	42	3.62
10	0.53	48	4.37
12	0.61	54	6.25
14	0.81	60	8.25
16	0.94	72	12.50
18	1.00	84	15.00
20	1.25		

10.11 STEEL PRESSURE TUBING (COLD DRAWN, SEAMLESS)

Outside dia., in.	Wall thickness, in.	Inside dia., in.	Weight per lin ft, lb
$\frac{3}{8}$	0.083	0.459	0.4805
$\frac{1}{2}$	0.049	0.652	0.3668
	0.050	0.650	0.3738
	0.065	0.620	0.4755
	0.095	0.560	0.6646
$\frac{7}{8}$	0.050	0.775	0.4406
	0.065	0.745	0.5623
	0.075	0.725	0.6408
	0.095	0.685	0.7914
1	0.050	0.900	0.5073
	0.049	0.280	0.4977
	0.065	0.870	0.6491
	0.083	0.834	0.8129
	0.095	0.810	0.9182
$1\frac{1}{8}$	0.065	0.995	0.7359
	0.085	0.768	0.9237
$1\frac{1}{2}$	0.065	1.120	0.8226
$1\frac{3}{4}$	0.075	1.350	1.141
	0.085	1.330	1.285
	0.110	1.280	1.633

10.12 IRON PRESSURE TUBING (COLD DRAWN, SEAMLESS)

Size, in.	Outside dia., in.	Wall thickness, in.	Inside dia., in.	Weight per lin ft, lb
$\frac{1}{2}$	0.675	0.091	0.493	0.5676
	0.840	0.109	0.622	0.8510
	1.050	0.113	0.824	1.131
	1.315	0.133	1.049	1.679
$1\frac{1}{2}$	1.900	0.145	1.610	2.716
2	2.375	0.218	1.939	5.022
$2\frac{1}{2}$	2.875	0.203	2.469	5.793
$2\frac{3}{4}$	2.875	0.276	2.323	7.661

SECTION XI
Miscellaneous

11.1 CYLINDRICAL TANKS

Dia., ft-in.	Vol. per lin ft, cu ft	U.S. gal per lin ft	Dia., ft-in.	Vol. per lin ft, cu ft	U.S. gal per lin ft
1-0	0.785	5.87	13-6	143.14	1,070.80
1-6	1.767	13.22	14-0	153.94	1,151.50
2-0	3.142	23.50	14-6	165.13	1,235.30
2-6	4.909	36.72	15-0	176.71	1,321.90
3-0	7.069	52.88	15-6	188.69	1,411.50
3-6	9.621	71.97	16-0	201.06	1,504.10
4-0	12.566	94	16-6	213.82	1,599.50
4-6	15.90	118.97	17-0	226.98	1,697.90
5-0	19.63	146.88	17-6	240.53	1,799.30
5-6	23.76	177.72	18-0	254.47	1,903.60
6-0	28.27	211.51	18-6	268.80	2,010.80
6-6	33.18	248.23	19-0	283.53	2,120.90
7-0	38.48	287.88	19-6	298.65	2,234
7-6	44.18	330.48	20-0	314.16	2,350.10
8-0	50.27	376.01	20-6	330.06	2,469.10
8-6	56.75	424.46	21-0	346.36	2,591
9-0	63.62	475.89	21-6	363.05	2,715.80
9-6	70.88	530.24	22-0	380.13	2,843.60
10-0	78.54	587.52	22-6	397.61	2,974.30
10-6	86.59	670.74	23-0	415.48	3,108
11-0	95.03	710.90			
11-6	103.87	776.99			
12-0	113.10	846.04			
12-6	122.72	918			
13-0	132.73	992.91			

11.2 SEPTIC TANKS

The standards and accommodation figures are for general information and do not necessarily agree with any specific federal or local authority requirements. Legal requirements should be checked before specifying or designing septic tanks.

Vertical Metal Tanks

Liquid capacity, gal	Dia., in.	Ht., in.	Wt., lb	No. of persons accommodated (approx)			Wall thickness, gauge
				Homes	Schools	Industrial	
300	48	48	250	4	25	20	14
320	48	50	360	5	25	20	14
500	53½	60	360	5	40	35	14
535	55	60	800	8	45	40	12
600	58½	60	390	6	50	45	14
735	65	60	1,290	10-30	55	50	10
750	62½	66	602	8	70	65	12
1,000	75	60	1,650	30-40	85	70	10
1,500	92	60	1,950	40-70	150	110	10

Courtesy Kaustine Furnace and Tank Co.

Precast Concrete Tanks

Liquid capacity, gal	Dimensions, ft-in.			Approx weight, lb
	L	W	H	
600	7-0	3-6	5-8	5,350
900	8-0	4-0	6-3	6,750
1,000	8-0	4-0	7-1	7,500
1,500	10-6	5-0	6-11	10,500
2,000	10-6	5-0	7-11	14,000

Courtesy American Precast Tank Co., Inc.

11.2 SEPTIC TANKS (Cont.)

The standards and accommodation figures are for general information and do not necessarily agree with any specific federal or local authority requirements. Legal requirements should be checked before specifying or designing septic tanks.

Horizontal Metal Tanks

Liquid capacity, gal	Dia., ft-in.	Ht., ft-in.	Wt., lb	No. of persons accommodated (approx)			Wall thickness
				Homes	Schools	Industrial	
500	4-6	4- 8	415	10-20	40	35	12 gauge
1,000	4-6	9- 3	825	20-40	80	70	12 gauge
1,500	4-6	13-10	1,130	40-75	120	105	$\frac{3}{8}$ in.
2,000	6-0	10- 8	2,270	75-100	165	140	$\frac{3}{8}$ in.
2,500	6-0	13- 2	2,675	100-125	210	175	$\frac{3}{8}$ in.
3,000	6-0	15-10	3,095	125-150	250	200	$\frac{3}{8}$ in.
3,500	6-0	18- 6	3,525	140-175	290	235	$\frac{3}{8}$ in.
4,000	6-0	21- 2	3,945	160-200	330	270	$\frac{3}{8}$ in.
4,500	6-0	23-10	4,395	180-225	370	305	$\frac{3}{8}$ in.
5,000	6-0	26- 4	4,800	200-250	410	340	$\frac{3}{8}$ in.
4,500	7-6	14-10	5,365	180-225	370	305	$\frac{1}{2}$ in.
5,000	7-6	16- 6	5,790	200-250	410	340	$\frac{1}{2}$ in.

Courtesy Kaustine Furnace and Tank Co.

11.3 FUEL OIL TANKS

Capacity, gal (U.S.)	Diameter, ft-in.	Length, ft-in.
280	3-6	4-0
550	4-0	6-0
1,000	4-0	10-8
1,000	5-4	6-0
1,500	5-4	9-0
2,000	5-4	12-0
3,000	5-4	18-0
4,000	5-4	24-0
5,000	6-0	23-9
5,000	7-0	17-6
6,000	8-0	16-0
8,000	8-0	21-4
10,000	10-0	17-2

11.4 FIBER ROPE

These values are for new rope. For old rope reduce values by half. For safe loads, use a safety factor of 4.

Threads	Dia., in.	Circum- ference, in.	Approx. length of full coils, ft	Approx. weight per coil, lb	Feet per lb	Breaking strength, lb	
						Manila	Sisal
6(fine)	$\frac{3}{16}$	$\frac{3}{8}$	3,000	45	66.6	450	360
6	$\frac{1}{4}$	$\frac{7}{8}$	2,750	55	50.0	600	480
9	$\frac{5}{16}$	1	2,250	65	34.5	1,100	800
12	$\frac{3}{8}$	$1\frac{1}{8}$	1,620	66	24.4	1,350	1,000
15	$\frac{7}{16}$	$1\frac{1}{4}$	1,200	63	19.0	1,750	1,400
18	$\frac{1}{2}$	$1\frac{1}{2}$	1,200	75	16.0	2,250	1,800
21	$\frac{9}{16}$	$1\frac{3}{4}$	1,200	90	13.3	2,650	2,120
	$\frac{5}{8}$	$1\frac{7}{8}$	1,200	125	9.61	3,450	2,760
	$\frac{11}{16}$	2	1,200	160	7.25	4,400	3,520
	$\frac{3}{4}$	$2\frac{1}{4}$	1,200	200	6.00	5,400	4,320
	$\frac{7}{8}$	$2\frac{1}{2}$	1,200	234	5.13	6,500	5,200
	$\frac{15}{16}$	$2\frac{3}{4}$	1,200	270	4.45	7,700	6,160
1	$\frac{1}{2}$	3	1,200	324	3.71	9,000	7,200
$1\frac{1}{8}$	$\frac{3}{4}$	$3\frac{1}{4}$	1,200	375	3.20	10,500	8,400
$1\frac{1}{4}$	$\frac{7}{8}$	$3\frac{1}{2}$	1,200	432	2.78	12,000	9,600
$1\frac{1}{2}$	$\frac{15}{16}$	$3\frac{3}{4}$	1,200	502	2.40	13,500	10,800
$1\frac{3}{4}$	$\frac{1}{2}$	4	1,200	576	2.09	15,000	12,000
$1\frac{7}{8}$	$\frac{11}{16}$	$4\frac{1}{2}$	1,200	720	1.67	16,500	14,800
$1\frac{1}{2}$	$\frac{3}{4}$	5	1,200	893	1.34	22,500	18,000
$1\frac{1}{4}$	$\frac{7}{8}$	$5\frac{1}{4}$	1,200	1,074	1.12	26,500	21,200
2	$\frac{1}{2}$	6	1,200	1,290	0.930	31,000	24,800
$2\frac{1}{8}$	$\frac{9}{16}$	$6\frac{1}{4}$	1,200	1,503	0.800	36,000	28,800
$2\frac{1}{4}$	$\frac{5}{8}$	7	1,200	1,752	0.685	41,000	32,800
$2\frac{1}{2}$	$\frac{3}{4}$	$7\frac{1}{4}$	1,200	2,004	0.600	46,500	37,200
$2\frac{3}{4}$	$\frac{7}{8}$	8	1,200	2,290	0.524	52,000	41,600
$2\frac{1}{2}$	$\frac{15}{16}$	$8\frac{1}{4}$	1,200	2,580	0.465	58,000	46,400
3	$\frac{1}{2}$	9	1,200	2,900	0.414	64,000	51,200
$3\frac{1}{8}$	$\frac{9}{16}$	$9\frac{1}{4}$	1,200	3,225	0.372	71,000	56,800
$3\frac{1}{4}$	$\frac{5}{8}$	10	1,200	3,590	0.335	77,000	61,600
$3\frac{1}{2}$	$\frac{3}{4}$	11	1,200	4,400	0.273	91,000	72,800
4	$\frac{7}{8}$	12	1,200	5,225	0.230	105,000	84,000

11.5 WIRE ROPE (6 strand, 19 wires)

Dia., in.	Approx. wt. per 100 ft, lb	Mild plow steel	Plow steel	Improved plow steel
		Breaking strength, lb		
$\frac{1}{8}$	10	4,140	4,780	5,480
$\frac{3}{16}$	23	10,000	11,000	12,600
$\frac{1}{4}$	40	17,000	18,800	21,600
$\frac{5}{16}$	63	26,200	28,800	33,200
$\frac{3}{8}$	90	37,400	41,200	47,400
$\frac{7}{16}$	123	50,800	56,000	64,400
$\frac{1}{2}$	160	68,000	73,000	84,000
$\frac{5}{8}$	203	83,000	92,000	106,000
$\frac{3}{4}$	250	102,000	113,000	130,000
$\frac{7}{8}$	360	145,000	161,000	185,000

Use of Wire Rope

Factor of Safety

Derricks	3.5
Guys	6.0
Hauling	6.0
Hoisting	5.0
Slings	8.0
Track cables	3.2

11.6 SAFE CAPACITIES OF CHAINS

Dia. of iron, in.	Safe capacity, lb			
	Used straight	Used at 60-deg angle	Used at 45-deg angle	Used at 30-deg angle
$\frac{1}{8}$	1,330	1,000	850	600
$\frac{3}{16}$	2,560	2,050	1,700	1,200
$\frac{1}{4}$	5,330	4,100	3,400	2,400
$\frac{5}{16}$	8,330	6,800	5,600	4,000
$\frac{3}{8}$	12,000	9,400	7,800	5,500
$\frac{7}{16}$	16,330	12,800	10,400	7,400
$\frac{1}{2}$	20,830	16,000	13,000	9,400

11.7 MATCHING ROPE TO BLOCK

Size of Block (Length of Shell), in.	Manila Rope Dia., in.
3	$\frac{3}{8}$
4	$\frac{7}{8}$
6	$\frac{1}{2}$
8	$\frac{3}{4}$
10	1
10	$1\frac{1}{8}$
12	$1\frac{1}{4}$
14	$1\frac{3}{8}$
14	$1\frac{1}{2}$
16	$1\frac{3}{4}$

Sheave Dia., in.	Wire Rope Dia., in.
6	$\frac{3}{8}$
8	$\frac{7}{8}$
10	$\frac{1}{2}$
12	$\frac{3}{4}$
14	$\frac{7}{8}$
16	$\frac{1}{2}$
18	$\frac{3}{4}$
20	1

Wood Snatch Blocks (Manila Rope)

Shell Length, in.	Rope Dia., in.
6	$\frac{3}{4} - \frac{1}{2}$
8	$1 - 1\frac{1}{8}$
10	$1\frac{1}{4}$
12	$1\frac{1}{2}$

11.8 GLASS

Sheet Glass

Type	Max. size	Approx. thickness, in.	Weight per sq ft, oz
Single strength	90 united in.*	0.093	19.5
Double strength	120 united in.†	0.124	26
Heavy sheet $\frac{3}{16}$ in.	76 × 120 in.	0.193	40
Heavy sheet $\frac{1}{2}$ in.	76 × 120 in.	0.217	45
Heat absorbing $\frac{7}{16}$ in.	50 sq ft per light	0.217	45
Picture	60 united in.	0.048	10
Picture	60 united in.	0.063	13
Picture	60 united in.	0.075	16

*United inches equals the sum of length plus width.

†Also available in sizes 16 × 18, 18 × 20, 16 × 24 and 20 × 20 in.

Wired Glass

Type	Max. size, in.	Weight per sq ft, lb
Hammered $\frac{1}{4}$ in.	48 × 144	3½
Hammered $\frac{3}{8}$ in.	48 × 100	5
Ribbed $\frac{1}{4}$ in.	48 × 144	3½
Ribbed $\frac{3}{8}$ in.	48 × 100	5
Polished:		
Hexagon mesh $\frac{1}{4}$ in.	60 × 144	3½
Square mesh $\frac{1}{4}$ in.	58 × 142	3½

Patterned Glass

Type	Thickness, in.	Max. size, in.	Weight per sq ft, lb	Light transmission, %
Hammered	$\frac{1}{16}$	48 × 132	2	90
	$\frac{1}{8}$	60 × 136	2.75	86
	$\frac{3}{16}$	48 × 100	5	80
Ribbed	$\frac{1}{16}$	48 × 132	2	88
	$\frac{1}{8}$	60 × 136	2.75	87
	$\frac{1}{4}$	60 × 144	3.3	86
	$\frac{3}{8}$	48 × 100	5	84

11.9 RESILIENT FLOORING TILE

Number of pieces of 9" x 9" tile for rooms of various sizes.

	3-9	4-6	5-3	6-0	6-9	7-0	8-3	9-0	9-9	10-6	11-3	12-0	12-9	13-6	14-3	15-0	15-9	16-6
3-9	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110
4-6	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126	132
5-3	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147	154
6-0	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176
6-9	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180	189	198
7-6	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
8-3	55	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220	231	242
9-0	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240	252	264
9-9	65	78	91	104	117	130	143	156	169	182	195	208	221	234	247	260	273	286
10-6	70	84	98	112	126	140	154	168	182	196	210	224	238	252	266	280	294	308
11-3	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330
12-0	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320	336	352
12-9	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340	357	374
13-6	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396
14-3	95	114	133	152	171	190	209	228	247	266	285	304	323	342	361	380	399	418
15-0	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440
15-9	105	126	147	168	189	210	231	252	273	294	315	336	357	378	399	420	441	462
16-6	110	132	154	176	198	220	242	264	286	308	330	352	374	396	418	440	462	484
17-3	115	138	161	184	207	230	253	276	299	322	345	368	391	414	437	460	483	506
18-0	120	144	168	192	216	240	264	288	312	336	360	384	408	432	456	480	504	528

11.9 RESILIENT FLOORING TILE (Cont.)

Number of pieces of 9" x 9" tile for rooms of various sizes.

	3-9	4-6	5-3	6-0	6-9	7-6	8-3	9-0	9-9	10-6	11-3	12-0	12-9	13-6	14-3	15-0	15-9	16-6
18-9	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550
19-6	130	156	182	208	234	260	286	312	338	364	390	416	442	468	494	520	546	572
20-3	135	162	189	216	243	270	297	324	351	378	405	432	459	486	513	540	567	594
21-0	140	168	196	224	252	280	308	336	364	392	420	448	476	504	532	560	588	616
21-9	145	174	203	232	261	290	319	348	377	406	435	464	493	522	551	580	609	638
22-6	150	180	210	240	270	300	330	360	390	420	450	480	510	540	570	600	630	660
23-3	155	186	217	248	279	310	341	372	403	434	465	496	527	558	589	620	651	682
24-0	160	192	224	256	288	320	352	384	416	448	480	512	544	576	608	640	672	704
24-9	165	196	231	264	297	330	363	396	429	462	495	528	561	594	627	660	693	726
25-6	170	204	238	272	306	340	374	408	442	476	510	544	578	612	646	680	714	748
26-3	175	210	245	280	315	350	385	420	455	490	525	560	595	630	665	700	735	770
27-0	180	216	252	288	324	360	396	432	468	504	540	576	612	648	684	720	756	792
27-9	185	222	259	296	333	370	407	444	481	518	555	592	629	666	703	740	777	814
28-6	190	228	266	304	342	380	418	456	494	532	570	608	646	684	722	760	798	836
29-3	195	234	273	312	351	390	429	468	507	546	585	624	663	702	741	780	819	858
30-0	200	240	280	320	360	400	440	480	520	560	600	640	680	720	760	800	840	880

11.9 RESILIENT FLOORING TILE (Cont.)

Net Covering Capacity per 100 sq ft

Tile size, in.	No. of pieces per 100 sq ft	No. of pieces per sq ft
6 × 6	400	4.00
6 × 12	200	2.00
9 × 9	178	1.78
12 × 12	100	1.00
12 × 24	50	0.50
18 × 18	45	0.45
18 × 24	34	0.33
18 × 36	23	0.23
36 × 36	11	0.11

11.10 SETTING BEDS FOR FLOOR AND WALL TILE

Thickness of setting bed, in.	Bed material per 100 sq ft of floor	
	Cement, bags	Sand, cu ft

Floor Tile (Mix 1:3)

1/4" tile	1.50	4.50
1/2" tile	2.25	6.75
1" tile	3.00	9.00
1 1/2" tile	3.75	11.25
2" tile	4.50	13.5
2 1/2" tile	5.25	15.75
3" tile	6.00	18.00
3 1/2" tile	6.75	20.25
4" tile	7.50	22.50
4 1/2" tile	8.25	24.75
5" tile	9.00	27.00

Walls (Mix 1:2)

1/4" tile	2.50	4.50
1/2" tile	3.40	6.75
1" tile	4.50	9.00

11.11 TERRAZZO MATERIALS

Proportions: 1 cement to 4 sand.

Setting bed thickness, in.	Quantities per 100 sq ft of floor	
	Cement, bags	Sand, cu ft
$\frac{3}{4}$	1.40	5.60
$\frac{7}{8}$	1.70	6.75
1	2.25	9.00
$1\frac{1}{4}$	2.80	11.25
$1\frac{1}{2}$	3.40	13.50
$1\frac{3}{4}$	4.00	15.75
2	4.50	18.00
$2\frac{1}{4}$	5.70	22.50
3	6.75	27.00

Terrazzo materials for $\frac{1}{2}$ in. thickness: 200 lb marble chips to 1 bag cement. Use 3 bags of cement plus 600 lb of marble chips per 100 sq ft of floor.

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